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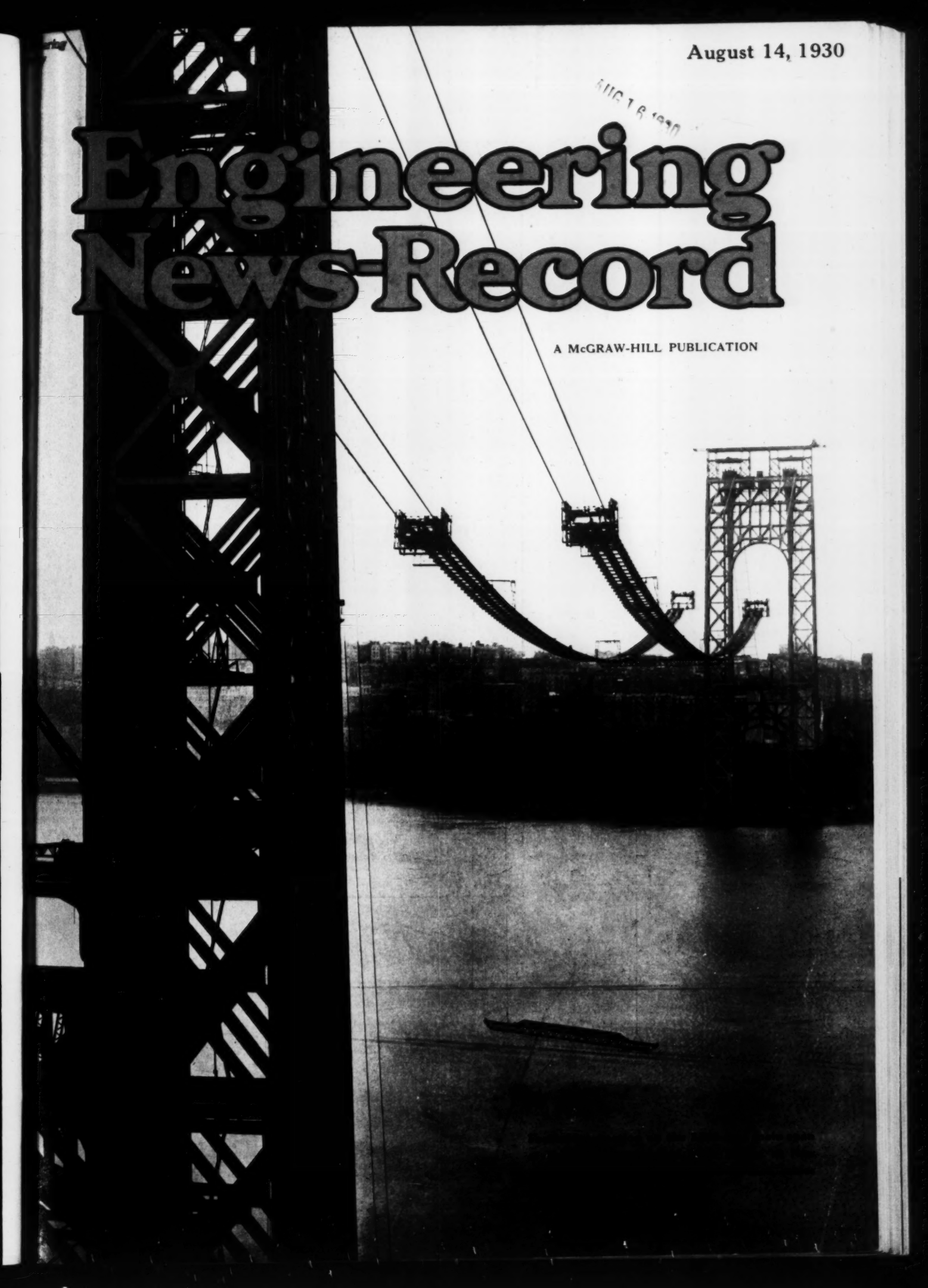

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

Volume 105 NEW YORK, AUGUST 14, 1930 Number 7

Dry Prospects

LITTLE hope of quick relief from the effects of the drought which has parched wide areas of this country during the past few weeks is found in the views of the government climatologists and hydrologists summarized in this issue. The period of deficient rainfall extends back to last fall in some parts of the country and back to late winter in others. This condition cannot but have a noticeable effect upon runoff and groundwater storage. Many streams are at low water stages never before reached until late fall. With depleted groundwater reserves, this condition presages a falling off of many water supplies through the autumn and winter and even into next year, regardless of any temporary relief which rains may bring. This is a development needing the attention of all engineers concerned with water supply, sewage disposal or power development. It is sure to affect this year's operations; it may affect all future planning if a new record for an extended period of low flow is established.

A Byproduct

A BYPRODUCT of the present drought, in so far as water users in North Carolina are concerned, is a new monthly rainfall and streamflow report prepared by the water resources and engineering division of the North Carolina department of conservation and development. The mounting deficiency of rainfall in many sections of the state has demonstrated how valuable such a report will be to those who not only must make the most of every drop of the present runoff but also must be in a position to judge as to how well their future requirements are to be met. What is true of North Carolina is true of most of the rest of the country. Increasing use of our water resources calls for wider dissemination of knowledge as to rainfall, runoff and groundwater conditions. It calls also for close co-operation between state authorities and private power companies, most of which maintain their own gaging stations. What North Carolina has done toward getting its data into the hands of its users quickly may well be used as an example by other states.

Fewer Strikes

THE END of the jurisdictional dispute strike in building operations is in sight. Late in July an agreement was reached between the executive committee of the National Association of Building Trade Employers and representatives of the building trade division of the American Federation of Labor which provides for setting up a national board of claims to settle all jurisdictional disputes. Strikes due to such disputes are prohibited. The agreement is to come up for final approval at the Boston meeting of the American Federation of Labor in October and approval is expected. Jurisdictional disputes for years have been one of the most needless and at the same time one of the most expensive troubles of the building industry. Anything which will put a check on them will be most welcome. Similar agreements have not proved highly successful in the past; it is to be hoped that the present one may prove more successful.

New York Is No Exception

TRAFFIC on many congested streets in New York City is moving faster. The simple expedient by which this has been accomplished is the reduction of the traffic interval, which has been abnormally long in both directions, and by the adoption of progressive lighting on crosstown streets. The resulting improvement in traffic has been hailed by the press with many felicitations for the traffic division of the police department, which instituted the change. Perhaps felicitations are quite proper, but they should represent the outpouring of thanksgiving that the narrow-mindedness with which New York traffic handling has been administered in the past presumably is at an end. For several years, with traffic congestion continually growing worse, with other cities proving the efficacy of short traffic intervals and of progressive lighting systems, New York has obstinately stuck to a two-minute traffic interval and a block system of control. "New York is different," said the traffic sages. Again it has been proved that it is not so different as some New Yorkers would like to think. Traffic congestion problems can never be solved without using all of the data that are so painstakingly being collected in every city in the country. Traffic control is not a local question any more than water supply and sewerage are local questions. Details may be affected by local conditions, but broad principles hold.

Make the New Start Right

A REORGANIZED highway administration has just assumed the task of redeeming Mississippi from the charge of being among the most backward of states in public-roads improvement. Unfortunately it also confronts the necessity of establishing confidence in its sincerity and honesty of purpose. Highways in this fruitful Southern state have so long been the shuttlecock of factional politics that suspicion of chicanery attaches to nearly every public-road policy enunciated or actively undertaken. All this the new commission has to overcome if it is to secure public support of adequate highway financing and restore the standing of the state as a recipient of federal aid. It possesses for this work the advantages of being compact enough for quick action and independent of appointive control. It is provided with a

director of highways of its own selection, and he with the approval of the commission selects a state highway engineer. Authority and direction are as closely knit as could be desired; if the commission fails of success it will be its own fault. Success patently will depend wholly on the integrity and ability of the men who become director and engineer and on their strong backing by the commission in the difficult labor of developing a business and technical organization for highway improvement. There can be no chances taken in the selection of these executives; they must be technically capable and militantly honest. The situation offers no place for mediocre or supine executive direction if Mississippi is to command rightful place among the leaders in state highway administration. It lacks this position today not because of poverty of highway funds or engineering inability, but because of a vicious political situation. No similar domination should be risked in the new start which has been made in developing modern state highways.

Drainage Lessons in Recent Construction

CONTROL of groundwater in excavation requires more specific study and counsel by the engineer than custom generally accords it. This conclusion is forced by the account in this and preceding issues of the River des Peres canal construction and by the engineers' report published last week of the Southfield Ave. sewer failure in Detroit. In the Detroit sewer work negligence of groundwater drainage introduced construction difficulties which are given as contributory causes of failure. On the River des Peres canalization similar disregard of preliminary drainage was a large factor in placing heavy loss on the contractor and compelling the city to turn to a profit-guaranteeing contract to forestall a rise to panic figures of bid prices for future work.

No personal criticism is implied in this selection of examples. The engineers did only what engineers are regularly doing. In one instance at least they did all that could be done after the work was begun to urge wiser practices. The contention is that groundwater study should not be held to be a function of the engineer after the fact, but should be a determined part of his planning and control of work.

Current drainage practice provides the engineer with a reasonably good technical armory for groundwater control in excavation. In recent years also the weapons have been greatly improved. Whether he turns to the prevailing method of permitting free seepage and then pumping the water, to inclosure of the excavation, to lowering the water table by drainage previous to excavation or to sealing the ground by injection or freezing, he can call upon more perfect equipment and better determined technique than have previously been available.

These means are effective; for evidence the search need go no farther than the operations whose unfortunate experiences have been mentioned and the current subway construction in New York City which is being described in a series of articles begun last week. These operations have employed successfully large isolated deep wells and small deep wells in groups for lowering the groundwater table, and well-point systems for progressively dropping groundwater level below excavation level. Progressively deepened ditches and pumping to sumps have kept dry large mileages of the subway excavation, and subgrade channels prevented slope seepage and wet bottom on much of the River des Peres open canal in earth. In instances the experiences have been contradictory, but broadly they demonstrate complete proficiency in groundwater drainage.

Uncertainty is most apparent in the effectiveness of isolated deep wells of several feet in section for general lowering of the water table. On the River des Peres work one such well had a material drying effect over an area involved in one contract. On the contrary, on one large contract on the New York subway a similar well proved a costly and rather useless experiment; the drop of groundwater level was confined to an area adjacent to the well that was too limited to be of much general benefit. These experiences confirm European studies of groundwater drainage, which have shown general lowering of level by single or widely spaced deep sumps to be essentially a function of soil characteristics and local conditions.

On the Detroit sewer work driven wells of smaller size grouped to embrace a desired area had a very effective drying action. These wells were sunk to lower the groundwater level so that damaged sections of the sewer could be unwatered for inspection. They were cased wells 10 in. in diameter and 60 ft. deep, with 10-ft. well screens at the bottom. On one section two wells were driven on opposite sides of the sewer, 45 ft. away from it, at the ends of a 100-ft. line crossing the sewer diagonally. On the other section two wells were driven on each side of the sewer at the corners of a rectangle 100 ft. long across the sewer and 80 ft. wide parallel to it. It is noted that the influence of these wells "extended out for a long distance in all directions," and that after the water level had once been dropped below sewer level, moderate pumping kept it there. So positive were the results that the method is recommended for reconstructing the sewer.

The inference is reasonable that the Detroit sewer materials—sand and gravel affording comparatively free groundwater flow—had a large part in the success of the ground-drying operation, but the approach to grouping of small wells bounding a defined area seems also certain to have been a factor. In general the evidence of experience is that there exists much greater opportunity for usefulness in lowering the groundwater immediately at the operation than in seeking to drop the water table over wider areas by isolated large wells. The justification of the well-point system rests largely on this reasoning.

Successful well-point installations are being employed for shaft sinking and other local ground drainage operations on the New York subways. Most often they have been operated to dry the ground in successive stages as the excavation deepened. Broadly, experience indicates well-point drainage to be successful in the degree to which the soil is free draining and to which the installation is adequate in size and depth and in complete closure of the excavation. In American practice well-point installations have frequently been rather tentative in character; European engineers have developed a less experimental policy with more assured results. There has been notable development, however, in recent well-point drainage technique in this country.

With the higher development of mechanical drainage, progressive lowering of groundwater by trenches to sumps still remains a largely employed and widely successful method. It has been developed to the magnitude of nearly standard practice in New York subway con-

struction. It was the leading factor in drying the excavation for lining the River des Peres open canal, where the excavation for the sanitary subsewer acted positively as a subgrade ditch for drying the canal slopes and bottom. In the sections of the New York subway where groundwater drainage is a figure, ditches along the cut progressively deepened drop the flow curve to slopes within the limits of the cut which permit successive depths of bottom up to 3 ft. to be taken out virtually in the dry.

In view of the evidence that groundwater drainage in excavation is becoming increasingly a problem of engineering appraisal of conditions (some of them highly complex) and engineering selection and adaptation of methods which require special knowledge, the question is justified whether in the light of usual practice engineering counsel is playing its full part in the drainage of excavation. Except in the occasional cases where surface flow or broached springs cause flooding, this operation is a problem in handling groundwater. In general, engineering plans and specifications disclose little information about groundwater conditions; much less do they undertake to indicate ways and means of seepage control. Both functions of determination and control are allotted to the excavating contractors. It is true that this practice is sanctioned by long precedent, but in the light of the River des Peres canal work and the Southfield Ave. sewer does this fulfill engineering responsibility? The question very definitely requires answer when financial loss and structural disaster loom as results of traditional practice.

An Equipment Triumph

THE LAST wire in the four 36-in. diameter cables of the Fort Lee bridge at New York was pulled across the Hudson River on August 7, marking the completion of the largest bridge cable-spinning operation yet undertaken. The tremendous total of 28,400 tons of wire, made up of 105,896 individual wires, each approximately one mile long, was spun in less than ten months. Record-breaking performances on construction operations have in recent years become commonplace. But when a great structure is built with remarkable speed and efficiency, using no radical or new methods but only old and tried procedure, there is a significant importance in what has been accomplished. The Fort Lee bridge in such a structure and the broad principle used by the engineers and contractors in attacking the problem of spinning its cables has wide application on other operations. Briefly, it points directly to the importance of mechanization.

A recounting of some of the steps by which the art of cable spinning has reached its present state of perfection will make the importance of the Fort Lee operation more real. In 1883, when the Brooklyn bridge was completed, its four 15¾-in. cables were spun one strand at a time, wire being supplied to a single spinning wheel from one side of the river only. Spinning required 21 months. Typical of the bridges of the early part of this century, spinning of the four 18¾-in. cables of the Williamsburg bridge was accomplished in seven months with two spinning wheels on one tramway system serving two cables, so that two strands per cable were strung at one time. The Bear Mountain bridge, completed in 1924, saw the use of two tramway systems, each with two spinning wheels, permitting simultaneous construction of four strands per cable and the laying up of the two 18-in. diameter cables in approximately three months. On the Bear Mountain bridge there was also inaugurated the practice of binding the completed individual strands with flat bands, which were left in the cable. Previously, when using round binding wires which had to be removed, the cables were constructed in layers. With the flat permanent bands the cables could be compacted from the hexagonal form as spun to the finished circular cross-section in one operation. A year after Bear Mountain, the Philadelphia-Camden bridge was finished, and faster spinning records were again made, the two 30-in. cables, more than twice as large as any previously built, being spun between August and December, 1924. A tramway system for each cable was again used, permitting four strands per cable, or eight on the bridge, to be spun at one time.

In comparing these past performances with that on the Fort Lee bridge, the magnitude of the latter project should be used as a background. Its suspended span is approximately twice as long as any other bridge and its cables contain more wire than the next seven largest suspension bridges combined. Any long bridge has an advantage over a shorter one when a comparison is made on a tonnage basis, because each trip of the spinning wheel on the longer bridge results in a greater tonnage laid. On almost any other basis, however, the comparison is fair. Spinning four 36-in. cables between October 18, 1929, and August 7, 1930, represents an average of 85 wires per hour. The average on the Camden bridge was 61 wires per hour, with the spinning wheels traveling only half as far as on the Hudson River structure. Two spinning wheels were used per cable on the Fort Lee bridge, permitting four strands per cable, or sixteen strands in all, to be spun at one time. The wheels traveled from anchorage to anchorage at a speed of 650 ft. per minute, against a speed of 400 ft. per minute, the previous maximum on other projects.

There is an adequate if simple reason for this unusual advance in speed and efficiency. It lies in the equipment used. With a contract totaling almost $12,000,000, the spinning contractor was enabled, if not compelled, to develop his working equipment to the highest degree. Speed in spinning was the end sought, with the result that the wire reels were driven by individual motors. On former projects the wire was unreeled by the spinning wheel as it pulled the wire across to the far anchorage. Special split sheaves for supporting the tramway rope enabled the Fort Lee spinning wheels to travel at maximum speed even over the deflecting sheaves at the tower tops and cable bents. A novel counterweighting tower allowed the necessary synchronization of the rate of unreeling with the speed of the spinning wheel. Electric signal systems permitted the rapid interchange of information at all times.

In effect the requirements in working equipment inaugurated on the Fort Lee bridge gave the spinning of the cables more of the characteristics of a manufacturing program than of the usual construction operation. The engineers of the Port of New York Authority and of the John A. Roebling's Sons Company have advanced the art of suspension bridge construction a long step forward. Machine refinement and control constituted the necessary tools. The Fort Lee cables truly represent an equipment triumph. This fact should be kept constantly in mind when reading the unusually complete account of the Fort Lee cable spinning that we are enabled to present in this issue.

Spinning Four 36-In. Cables for the Fort Lee Bridge

Elaborate Electrically Operated Plant of Cable Contractor Spins 28,400 Tons of Wire in 9¾ Months on Hudson River Structure—Spinning Wheels Travel Mile Between Anchorages 60 Per Cent Faster Than on Any Previous Project by Virtue of Driven Reels and Improved Tramway Supports—Stepped Footbridges on Side Spans

By E. Warren Bowden

Assistant to Chief Engineer, The Port of New York Authority

THE CABLES for the new bridge over the Hudson River between Fort Washington Park in New York City and Fort Lee in New Jersey are now rapidly nearing completion. On August 7 the last wire of the total of 105,896 wires was spun, signalizing the placing in a single project of more wire than the sum of that contained in the next seven largest suspension bridges now in existence. In addition, the spinning was completed in 9½ months, the first wire having been placed Oct. 18, 1929. The wire in the four 36-in. diameter cables weighs 28,400 tons.

The entire bridge is of unusual proportions, its center span of 3,500 ft. being practically double that of any bridge previously built. The massive steel towers supporting the four cables rise more than 600 ft. above the water level and thus exceed in height all but the very tallest buildings in our large cities. Other articles treating various phases of the project have been published in *Engineering News-Record* as follows: "Design Considerations of Complete Project," Aug. 11, 1927, p. 212; "Design of Steel Towers," May 24, 1928, p. 819; "Deep Open Cofferdams for New Jersey Pier," Aug. 16, 1928, p. 232; "Construction of New Jersey Tunnel Anchorage," Oct. 25, 1928, p. 611; "Pouring 106,000-Cu.Yd. Block of Concrete for New York Anchorage," April 11, 1929, p. 591; "Manufacturing High-Modulus Footbridge Rope," May 1, 1930, p. 714.

The work of spinning the cables involved many interesting problems and many improvements incidental to production on such an unprecedented scale. The contractor has used new types of footbridges and unusual methods of erection, including an improved design of tramway rope support, power drive and control of reels, an unusual and efficient installation of electric signal and operating equipment. The latter not only permits a close control of the entire spinning operation from a central dispatcher's office but also permits wire adjustments to be made at the towers one-third of a mile away by the observer at midspan. Also by a system of light signals, the progressive stages of wire adjustment are co-ordinated most effectively.

Elaborate Preliminary Studies

Although the method of wire-cable spinning introduced by John A. Roebling and first used in spinning the wires for the railroad bridge across the Niagara gorge in 1854 has remained fundamentally unchanged, each wire cable erected since that time has contributed something to the refinement and progress of the art. Increased spans using larger quantities of materials have necessitated constant refinements and improvements in the machinery used, but no suspension bridge heretofore has offered as manifold problems nor has justified as intensive experimentation and study in the solution of them as has the Fort Lee bridge with its 101,000 miles of wire to be spun under erection loads more than twice as large as any previously encountered.

For a period of many months the Port Authority engineers engaged in a detailed study of cable problems, weighing the relative merits of various cable arrangements, saddle designs, anchorage loads and erection problems in general. Bids were secured on both eyebar-chain and parallel-wire design. In the latter a complete set of plans was prepared for cables arranged in pairs, either one above the other or side by side. Also, bidders on wire cable were given the alternative of choosing the method of simultaneous or successive erection. In the case of successive erection, one cable of each pair would be spun first, the suspended structure hung, leaving as a final operation the spinning of the remaining two cables.

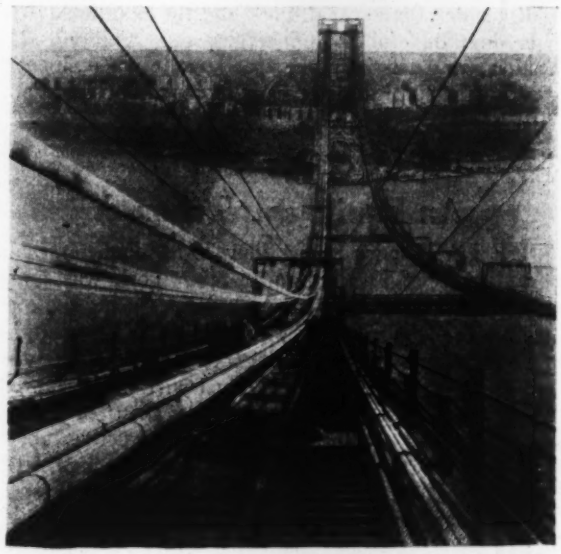


FIG. 1—MAIN-SPAN SPINNING LAYOUT—FORT LEE BRIDGE

Mesh used under cables to reduce weight of footbridges. Note steel headframes carrying four tramway ropes over each footbridge.

The John A. Roebling's Sons Co., the successful bidder, proposed at first to use this successive erection plan with cables side by side. However, as plans for accomplishing the transfer of load to the second set of cables began to mature, it became increasingly evident that the disadvantages of such a plan more than outweighed its

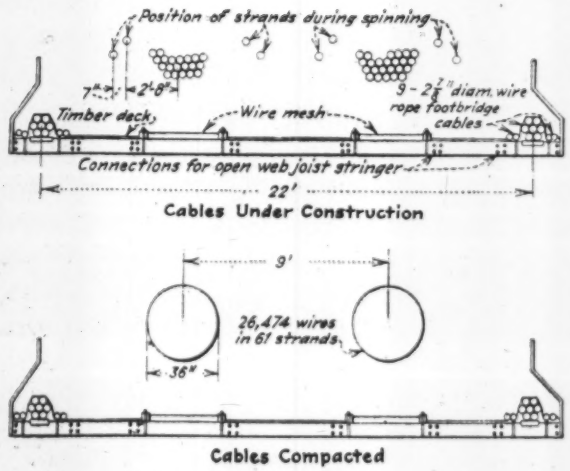


FIG. 2—RELATIVE ARRANGEMENT OF CABLES AND FOOTBRIDGE

Note grouping of footbridge ropes—seven ropes in a hexagon and one rope at either side.

advantages, which consisted mainly in the speeding up of erection of the suspended structure. At the suggestion of the Port Authority, the contractor, therefore, changed his plans to the system of simultaneous erection and undertook to complete the four cables in the time originally contemplated for two.

The Cables

The four cables are grouped in two pairs, 106 ft. apart, each pair centering over one side of the bridge. The cables of each pair are spaced 9 ft. centers. They are of the parallel-wire type, and each contains 26,474 cold-drawn galvanized wires, 0.196 in. in diameter. When completed the cables will be compacted to a diameter of 36 in. Each individual wire contained in the cables has a strength of more than 7,000 lb., representing an ultimate strength for the material of more than 240,000 lb. per square inch.

For purposes of construction, the cable was divided into 61 4½-in. diameter strands, each of which contains 434 wires. Each strand was independently spun and independently attached at the anchorage to a pair of eyebars forming the upper links of a chain which extends down into the concrete of the anchorage to anchor girders.

On the New York side the cable pull is resisted by a 260,000-ton mass of concrete and granite masonry. On the New Jersey side the cables are attached to eyebar chains which are anchored in concrete in tunnels extending approximately 150 ft. into the solid rock of the Palisades.

The cables are supported in cast-steel saddles at the towers and at the pedestals in front of the anchorages. Each tower saddle covers an area 8½ ft. in width by 28 ft. in length, is roughly 12 ft. high and weighs nearly 200 tons. The necessity for such unusual proportions is better understood when we consider that the load to be carried in each saddle may be as great as 30,000 tons. Each saddle is supported on a nest of 40 8-in. diameter rollers, which during erection permit the saddle to roll to a position corresponding to balanced horizontal pull from main and side spans, but which, after the completion of the bridge, will be locked in fixed position.

The anchorage saddles are much lighter and serve both as cable support and as splay casting. They are supported on rocker nests to provide for the necessary motions due to stretch under load and temperature changes.

Footbridges

The footbridges, of ample width to provide working room for two cables, are supported by two groups of nine steel-wire ropes, 2⅞ in. in diameter. When later removed and cut to length, these ropes will serve as suspenders in the permanent structure.

It has been the usual practice in previous cable-spinning operations to provide footbridge ropes in continuous length from anchorage to anchorage, determining the final length for cutting and socketing in the field after the ropes have stretched under their own load. For the Fort Lee bridge the contractor elected to provide separate rope lengths for main and side spans, prestressed at the manufacturing plant to loads corresponding to those to be encountered under working conditions, thus permitting cutting and socketing before shipping to the bridge site.

In erecting the footbridge ropes, the main-span ropes were laid out between the tower bases on the bed of the river and attached by pennant lines to the side-span ropes, which had been stretched out from either anchor-

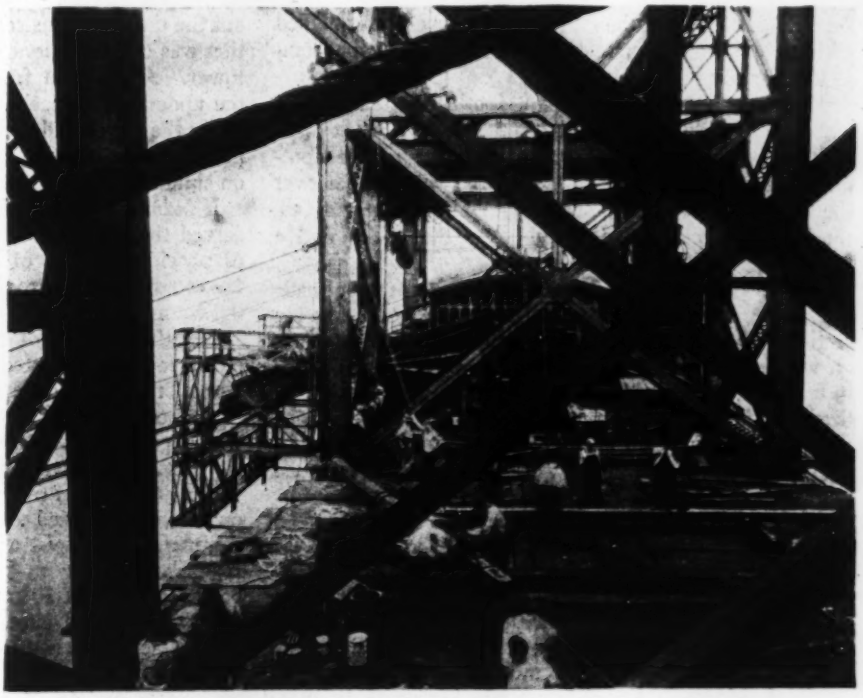


FIG. 3—ATOP THE NEW YORK TOWER, FORT LEE BRIDGE

Arched walkway in background follows outline of saddle which is 12 ft. high and 8½x28 ft. in plan. Steel superstructure shown is temporary, used to support bridge crane which handles completed strands and to carry other erection equipment. On footbridge ropes at left is carriage used to erect main-span footbridge sections. It is in position to be loaded.

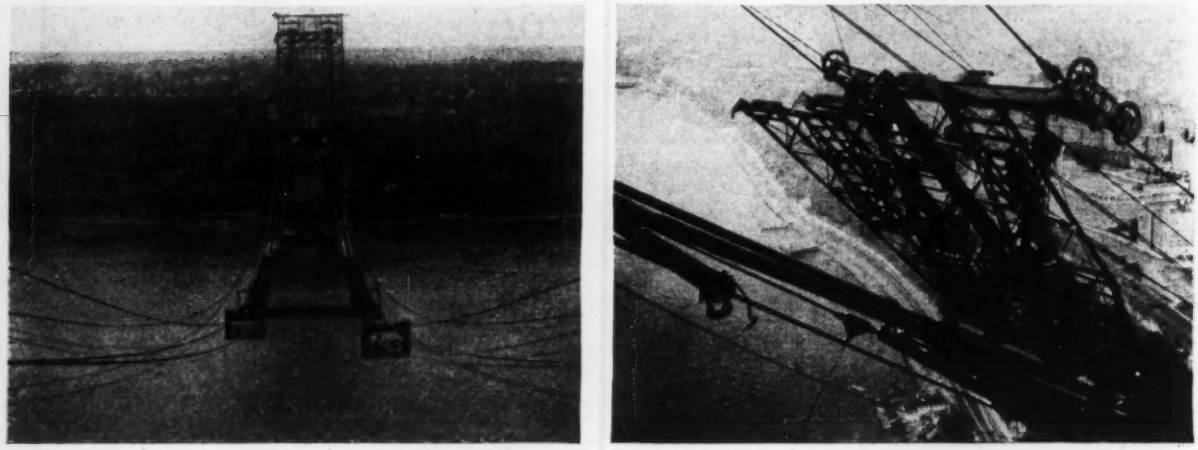


FIG. 4—ERECTING FOOTBRIDGE SECTIONS ON FORT LEE BRIDGE

Left: Main-span erection carriages; loaded with ten sections at platform on the face of the tower; run on footbridge ropes; equipped with hoist to handle sections into position. Right: Side-span erection carriage bringing stepped footbridge panel into position. Note how hooks at top will fit over pipe crossbeam fastened to footwalk ropes.

age. After being hoisted to the tower top and lowered into a supporting frame, the pennant line was replaced by a permanent connection consisting of threaded rods passing through clamps fastened to the ropes at the sockets. The connection thus provided permitted about 5 ft. adjustment in rope length at each tower. No adjustment was provided at the anchorages, at which point the nine ropes forming a group are held in a single structural frame, pin-connected to a chain of anchoring eyebars.

The first footbridge rope was hoisted to the tower tops on July 9, 1929, and eight days later all were in place.

The entire area of the tower top, approximately 200 x 40 ft., is surmounted by a structural framework about 50 ft. high, composed of 30-in. column sections securely braced, carrying transverse beams and longitudinal girders. Running upon the latter is a girder crane equipped with two 65-ton electric hoists for handling the completed strands.

Main Span—The main-span footbridge decking is made up of light welded structural sections, 25 ft. wide and 12 ft. long, clamped immediately below the footbridge ropes. The sections are floored with timber over the working areas, but in order that weight may be saved, the timber is omitted directly below the cables and a heavy wire mesh substituted.

To erect the footbridge sections the contractor made use of four large carriages (Fig. 4), each carrying ten sections, which moved out on the footbridge rope groups on wooden wheels; 1-in. endless tramway ropes, erected in temporary position and driven by 100-hp. electric motors located on the superstructure, hauled each carriage from its loading position at the tower to the center of the main span. The sections were raised from the ground in skips lifted by the overhead cranes on the tower top, which were permitted to run beyond the tower faces by means of cantilever runway brackets. From the skip the sections were transferred to push cars running on a platform located on the river face of the tower at an elevation which permitted the car with its load of sections to run under the erection carriage. From this position the group of sections was hoisted into the erection carriages.

The decking was placed first at the center of the main span, working thence toward the towers. All main-span sections were erected in eight working days.

Side Spans—In the side spans the footbridge-rope groups do not follow the curve of the cable but approach the anchorage at a higher elevation. It was therefore necessary to suspend the side-span decking from these groups in order that the desired working position below the cables might be secured. The side-span sections are made up of light trusses in the form of flights of steps and landings, as shown in Fig. 4. Three sections placed side by side and connected by their timber platforms form a panel. In the space directly beneath the cable the timber is omitted, heavy wire mesh being used as in the main span.

The 11-in. diameter pipe floorbeams which occur at each side-span panel point were first spaced along 2-in. ropes, and each pipe was suspended at its ends from the main rope groups above. In erecting the sections, carriages running on $1\frac{3}{4}$-in. ropes in temporary position carried out the three sections composing a panel at a time. Erection was carried forward from the anchorage toward the tower. As is plain from Fig. 4, hook-shaped angles at the upper end of each section engaged a pipe floorbeam, while the lower end was bolted to the section previously placed. The erection of side-span decking was carried on simultaneously with the work in the main span.

Windbracing—The five crosswalks in the main span served the double purpose of stabilizing the system and of providing means of passage between the footbridges. No crosswalks are provided in the side spans, which have the comparatively short length of 700 ft.

For the purpose of resisting wind uplift a system of storm ropes was erected below the main-span footbridges. An interesting feature of this storm system as installed is the counterweighting applied to the main storm ropes which pass completely across the river. The counterweights at the towers maintain equal tensions under the varying conditions of temperature and deflection. From experiments carried on with models at the plant, the contractor developed a rather elaborate system of wire-rope crossbracing to booms suspended below the footbridges and about 500 ft. from the towers. These booms were difficult and expensive to erect and their effectiveness is open to some question, but the action of the storm system as a whole has been highly satisfactory with very little motion of the footbridges during winds of high velocity.

The elaborate character of the spinning plant is evident from Fig. 5, which shows the layout at the New Jersey

anchorage and on top of one of the main towers. So far as equipment is concerned, that in the New York anchorage is almost identical with that at the New Jersey end. One endless tramway rope, operating in either direction and carrying two spinning wheels attached at directly opposite points, is provided for each cable. Each rope is driven at the New Jersey anchorage by a 100-hp. electric motor; at the New York anchorage the ropes pass around idler sheaves. Tension is maintained by adjustable sheaves at the New Jersey end. The steel tramway headframes, placed at 200-ft. intervals along the footwalks, are innovations, those on previous bridges being made of timber. The reeling machines shown in Fig. 5 are driven by hydraulic motors providing exact control and fast operation of the spinning wheels. The floating counterweight shown in the tower is necessary because of the fast operation being used by the operator to assure constant and proper tension in the wire being spun. A telephone and electric signal system for dispatching and wire-adjustment operations makes the spinning operation as efficient and as fast as progress of other parts of the project warrant.

The wire to be spun was manufactured in coils about 4,000 ft. in length. At the plant, the coils were spliced and wound on special metal reels, having a barrel diameter of 6 ft., a loaded weight of more than 13,000 lb. and a capacity of 25 miles of wire. The reels were moved by rail from the plant at Roebling, N. J., to New York harbor on special cars equipped with steel cradles. The cars were delivered by car float to the tower bases, where the reels were transported to the anchorages by inclined cableways.

The Guide Wires—Preparation of the guide wires, the standards of length against which all strands are compared while being spun, constitutes the first operation of a cable-spinning job. This is done by measuring its length from observation of sags determined with surveying instruments. On the Fort Lee bridge the difficult observations usually necessary to obtain side-span lengths were entirely avoided by mounting the wire on small rollers at the points of support in the tower saddles. The wire was thus able to move to a condition of equilibrium with equal tensions on the wire on both sides of the saddle. Observations of main-span sag alone gave sufficient data for computing the entire length.

For each cable four strands were spun at a time, and during the process were supported in temporary position on brackets fastened to the outside of the saddle castings. When marked for length, one guide wire was placed in each of these spinning supports and its ends were attached to strand shoes at the anchorages. The strand shoes are of usual design, on this bridge capable of retaining 217 loops (434 wires), and provide for a total adjustment of 10½ in. by means of shims.

The Spinning Process—During the spinning process, the strand shoes were mounted on a "strand leg," a bulky steel casting, weighing approximately 5 tons, which holds them in a vertical position in advance of their final location at the eyebars. The leg must safely withstand a pull of 130 tons as well as bending arising from the necessity of leaving one side open for placing loops of wire around the strand shoe, as shown in Fig. 8.

In spinning the strands the reels of wire were mounted on unreeling machines at both anchorages. The free end

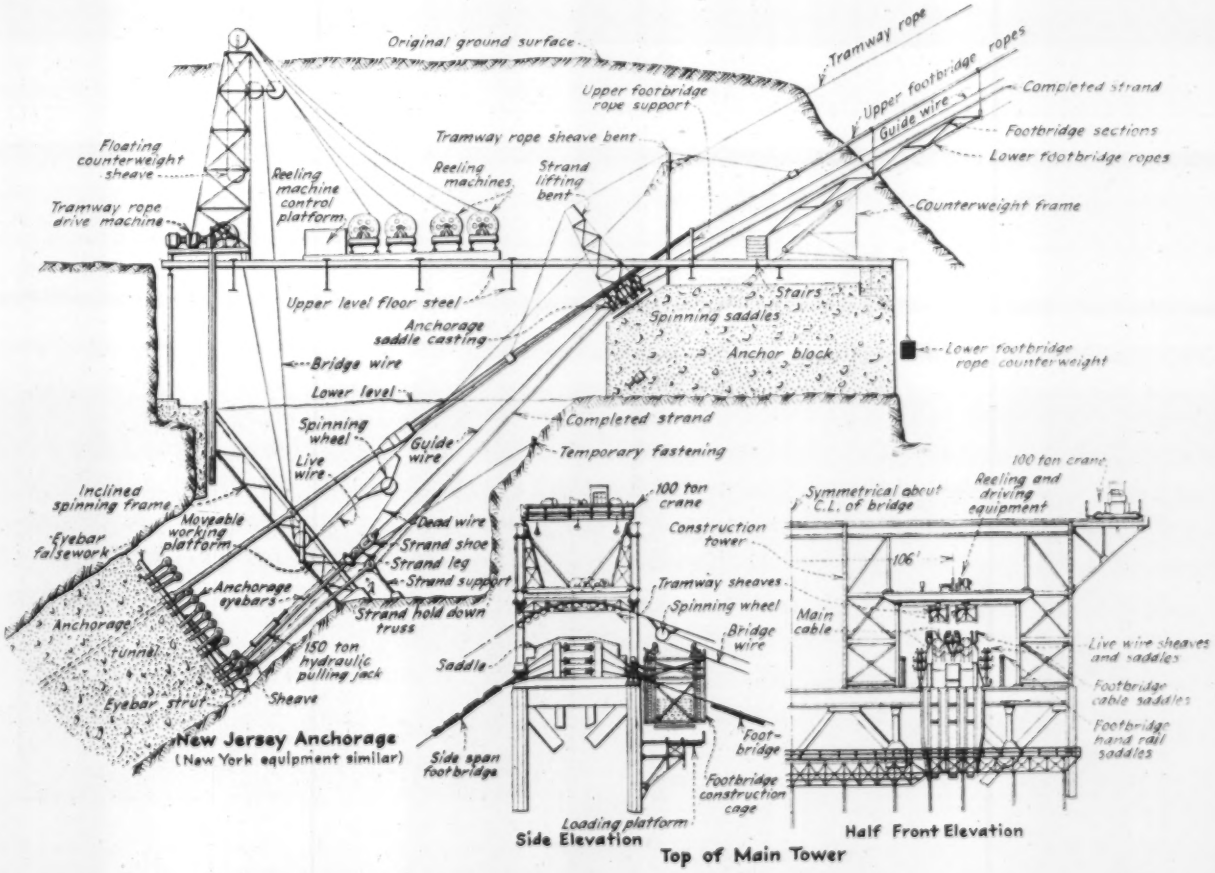


FIG. 5—LAYOUT OF WIRE-SPINNING EQUIPMENT, FORT LEE BRIDGE

of the wire, from a reel located, say, on the New Jersey side, was temporarily fastened at a fixed point in front of the strand shoe and the wire looped around the strand shoe. The bight of wire thus formed was placed over the 5-ft. diameter spinning wheel, which is deeply flanged to receive it, and the spinning wheel was propelled across the river by the hauling rope, unwinding the wire from the reel by progressively lengthening the bight. Reference to the left end of the "first trip" diagram in Fig. 7 will assist in making this operation plain.

Arriving at the New York anchorage, the wire loop was removed from the wheel and placed around a strand shoe. The companion spinning wheel, attached to the same hauling rope, similarly and simultaneously pulled out two wires from the New York anchorage which were looped over a strand shoe at the New Jersey end. Thus the two spinning wheels for each cable spun four strands at one time, as shown in Fig. 7. All wire for two of the strands originated at one side of the river and all wire for the other two strands originated on the opposite side.

Of each of these two pairs of wire, the "dead" wire—that is, the branch of the loop whose end was fixed at the starting point—was successively adjusted behind the traveling wheel, so as to hang at predetermined sags in the first side span and in the main span. The sags were measured by comparison with the guide wires. After the loop was placed around the far strand shoe, the dead wire was adjusted in the last side span, and the "live" wire—that is, the branch of the loop which unwound from the reel—was successively adjusted in the last side span, the main span and the first side span, and placed around the strand shoe at the point of beginning, thus forming another loop to be pulled across by the spinning wheel.

This operation was repeated until the 217 loops or pairs of wire of a strand had been placed. The ends of the wire last pulled across was then spliced to the end of the wire fastened in front of the shoe at the start. Thus the strand was formed by a continuous length of wire. With all wires in place, the strands were lightly compacted by hand clamps and seized at intervals of 5 ft., ready to be picked from the spinning supports and lowered into position in the saddles. Views of this operation are shown in Fig. 6. Large balance beams were provided at the towers to accomplish this. Grommets or slings made of $\frac{3}{8}$-in. wire rope were placed under the

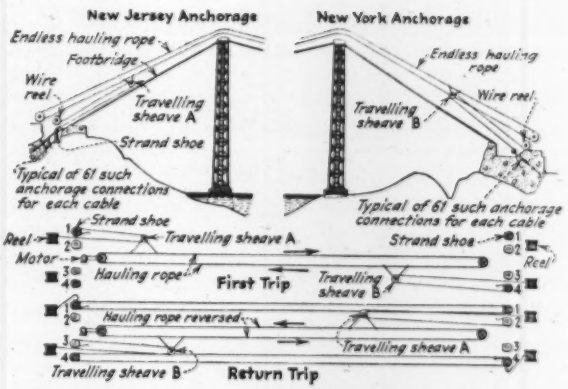


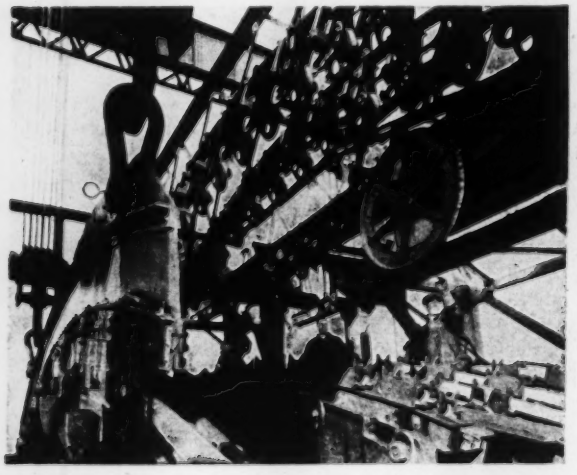
FIG. 7—DIAGRAMMATIC LAYOUT OF CABLE-SPINNING OPERATION

Reels and strands shown for one cable only. Note that on first trip wires are placed in strands 1 and 4 and on the return trip in strands 2 and 3.

strand and by means of grommet bolts a uniform tension was obtained on all the slings. The balance beam was then picked by the two hooks from the girder crane operating on the erection steelwork overhead. Approximately the same operation was performed at the anchorage saddles, where lighter loads permit the use of smaller balance beams, which are picked by 60-ton jacks.

Strand Adjustment—As the finished strand was lowered into the saddle the strand leg was jacked back, the attachment of strand shoe to the strand leg remaining until the shoe was finally fastened on its pin at the eyebars. This jacking was accomplished by means of a 150-ton hydraulic jack placed in a two-part wire-rope system which passed around a segmental sheave mounted on the pin at the lower end of the anchorage eyebar, as shown in Fig. 5.

A feature of the jacking arrangement was a set of bypass rods arranged so that they could be pinned off in varying positions, thus guarding against loss of the strand in case of jack failure. Two sets of jacking equipment were provided at each anchorage for each pair of cables.



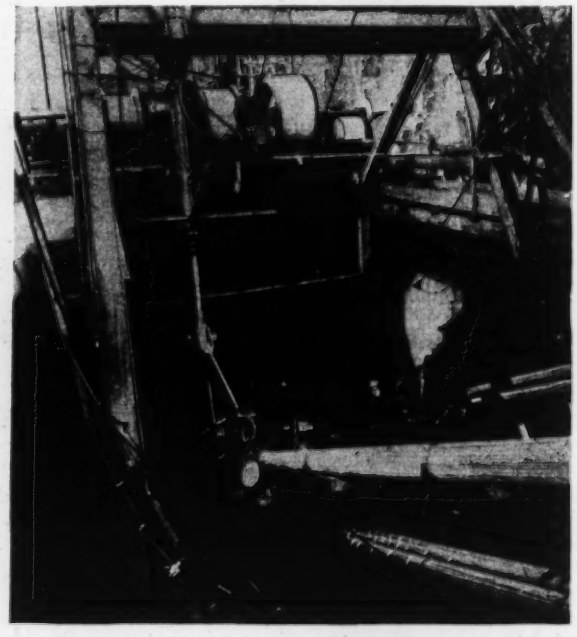


FIG. 6—HANDLING STRANDS AT CABLE SADDLES

Left: Strand being transferred to main tower saddle by balance beam attached to 65-ton hooks of overhead crane. Note other strands in temporary spinning supports; also spinning wheel passing through trolley blocks with a bight of cable wire. Right: Hydraulic hoist lifting strand into New Jersey cable-bent saddle which already contains three completed strands.

The first strand in each cable was set to the desired sags in the main and side spans by means of observations with survey instruments. All subsequent strands were adjusted to conform to the first and all adjustments in the main and side spans were obtained by jacking at the anchorage.

During the early stages of spinning, the saddles were set in position approximately 2 ft. shoreward of the center line of towers and were temporarily blocked against the possibility of rolling. Later this blocking was removed and the saddles permitted to roll, to balance the horizontal pulls exerted by the strands.

Plant Improvements

Certain items of equipment as installed for this work by the contractor are of unusual interest and have operated very successfully in the spinning and adjusting operations. An outstanding improvement relates to the speed of the spinning wheel, which was increased to 650 ft. per minute, compared with a maximum of 400 ft. per minute previously attained in work of this nature. Moreover, the speed was maintained continuously throughout the entire trip between anchorages, no slackening of speed being required as the wheels passed over the towers. Speed in adjusting also kept pace with the increased speed of the spinning wheel. These important advances in the art are due principally to three distinctive features: power drive for the reels, improved tramway-rope supports, and an electric signal and control system.

On each anchorage two unreeling machines (Fig. 9) were provided for each cable. Heretofore the wire has been pulled from the reels by the action of the spinning wheel, a brake being used to control its motion. This problem of control became of great importance in consideration of the heavier reels used on the Fort Lee bridge, the greater speed of travel of the spinning wheel and the greater accumulation of slack over the 5,000 ft. of length between the anchorages.

The unreeling machines were designed to engage the drum of the loaded reel, a 100-hp. electric motor furnishing the power to drive four unreeling machines. They were controlled by a hydraulic system, which was readily manipulated and permitted rapid changes in speed. The operator synchronized the speed of the unreeling machine with the speed of the spinning wheel by the use of a counterweight frame or tower which was erected in front of the reeling machine location on the top of the anchorage, as shown in Fig. 5. The wire coming from the reel passed over a sheave or wheel at the top of the counterweight tower, thence looped down around a weighted sheave and passed again over a wheel at the top of the frame. By observing the position of the counterweighted sheave as it rode on the suspended loop in the frame, the operator was able to drive the unreeling machine at the rate required by the spinning wheel that was pulling out the loop.

The method of attachment of the spinning wheel to the tramway rope is especially important, and on this work the offsetting "gooseneck" used on former projects was eliminated. Instead, the frame was hung directly below the rope and at the rope consisted of plate connections ¼ in. thick. Between the two points of attachment of the frame the diameter of the tramway rope was enlarged to that of the connection by a continuous series of interlocking sectional rings. Beyond the frame the diameter then tapered to the original rope section.

The tramway rope retaining wheels on the overhead frames were arranged in sets such that two sheaves or wheels located just above the rope took a slight reaction from the running rope under ordinary conditions, while at the time of passage of the spinning wheel its weight forced the rope down on a pair of wheels which had outside flanges only, were set at an inclination to each other and were so spaced as to permit the free passage between them of the ¼-in. plate connections of the spinning wheel frame.

On this work the necessity of visual signals between the adjuster at midspan and the men operating the "come-along" was eliminated. The "come-alongs," which grip the wire and permit of its being pulled up or slacked off as desired, were operated by a motor controlled by the observer at midspan. This enabled him to adjust the wire to correct sag and having accomplished this, he signaled the fact ahead by turning a switch which lighted a lamp on an indicator panel at the adjustment point, where the wire was then clamped off and the signal passed along.

FIG. 8—SPINNING ARRANGEMENT AT STRAND SHOE
Strand leg is a large U-shaped casting which holds shoe during spinning in vertical position ahead of its final position which is pinned to the eyebar head at left. Shoe is pulled back to final position by 150-ton jacks shown in Fig. 5.

A number of control points for making emergency spinning wheel stops were located along the footwalks. A complete system of telephones was also maintained.

The despatcher house, located in the cut just behind the New Jersey anchorage, was an innovation on a spinning operation. At this point record was kept of the progress of the wheel. If stopped at any point on the walk the annunciator system immediately gave the position and the operator was able to obtain the reason by phoning to the indicated location. Unnecessary delays and misunderstandings were thus eliminated and lost time due to wheel stoppages reduced to a minimum.

The adjustable working platforms, shown in Fig. 5, riding on inclined trusses at the anchorages, and the girder crane and runway for handling reels to the New Jersey anchorage may be mentioned as other important features of the plant.

The hydraulic splicing equipment warrants a brief

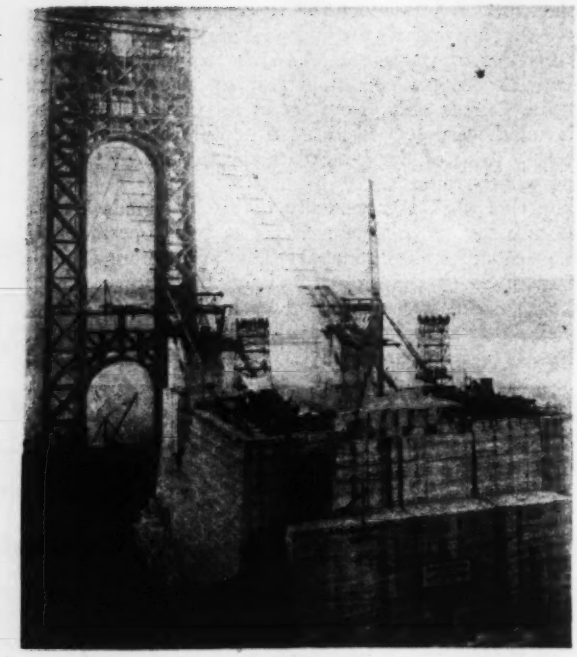


FIG. 9—CABLE-SPINNING EQUIPMENT AT THE NEW YORK ANCHORAGE

Footbridges under construction. Note two counterweight towers on top of anchorage which assure proper tension in the spinning wire. Note also hubs for wire reels.

lescription. Machines identical with those used in making splices in the shop were installed at the anchorages. The end of a wire to be spliced was so pressed that an elliptical section was produced at each groove, no attempt being made to secure a thread. The ferrule or coupling was roughened on the inside. In making a splice the ferrule was laid between the jaws of a hydraulic press, the wires to be spliced entered at either end, and a pressure of about 200,000 lb. maintained for one minute. Such splices proved almost 100 per cent efficient.

Spinning Organization

As a matter of efficient organization, the work was carried on in such a way that spinning was in progress on three cables while the fourth was in the process of strand adjustment. Such an arrangement allowed for the best utilization of equipment. Also, by this plan of operation only three spinning crews were required and these could be kept continuously occupied. It also proved advantageous to have a group of men at each anchorage who did nothing but adjust strands. An average of a dozen men were employed at each anchorage for this purpose. Crews of eight men were also required for adjusting at the tower tops. During spinning approximately 65 men were scattered throughout the length of each cable. A total of about 375 men was engaged in the cable-spinning operation.

The minimum time required for spinning a set of strands was nine calendar days. Adjusting and preparing the next set-up of eyebars and strand legs, etc., required another two to three days, making a total period of about twelve days.

Steps Following Completion of Spinning

Following completion of the spinning the cable must be compacted between points of support. The squeezing will be accomplished in two stages. The first stage with a light squeezer will reduce the cable to a diameter of about 38 in. This operation will then be repeated using a heavier squeezer to reduce the cable to 36 in. The squeezer completely encircles the cable and pressure is applied radially on twelve segments.

Cast cable bands will be placed at each panel point for supporting two loops of suspender rope. The suspender ropes will be measured, cut and socketed at the site after removal from their present position as footbridge supports.

The wrapping, which is the last stage of the cable-manufacturing process, cannot be done until the suspended structure and roadway slabs are in place, in order that the cables may have attained as much of their stretch as possible. A soft annealed double-galvanized steel wrapping wire of 0.148 in. diameter will be used, wrapped under tension by machine. At the cable bands the wrapping is discontinued just under the lip of the band and lead wool is calked into the connection, the result being, when complete and painted, a very effective and relatively impervious protection for the cable wire.

Administration

The Fort Lee bridge is being built by the Port of New York Authority at an estimated cost of $60,000,000. Nine contracts covering various phases of the construction work have been let to date. The contract to furnish the wire and erect the cables, to furnish and erect the cable bands and suspenders and anchorage steelwork was awarded to the John A. Roebling's Sons Co., of Trenton, N. J., on Nov. 4, 1927, at an estimated contract price in excess of $12,000,000.

The design and erection of the bridge is under the direction of O. H. Ammann, chief engineer, the Port of New York Authority. Allston Dana is engineer of design and Leon S. Moisseiff advisory engineer of design. The field work and all phases of the erection are under the direction of Montgomery B. Case, engineer of construction. Homer R. Seely is resident engineer in charge of cable-spinning operations. C. C. Sunderland is chief engineer of bridges for the John A. Roebling's Sons Co., which company maintains a corps of engineers on the work with W. E. Joyce as resident engineer.

THE 3,500-FT. FORT LEE SPAN AT NEW YORK

Spiral-Flow Activated-Sludge Plant for Peoria District

Pre-Sedimentation With Heated Sludge Digestion Tanks for Solids From Both Primary and Final Settling Tanks

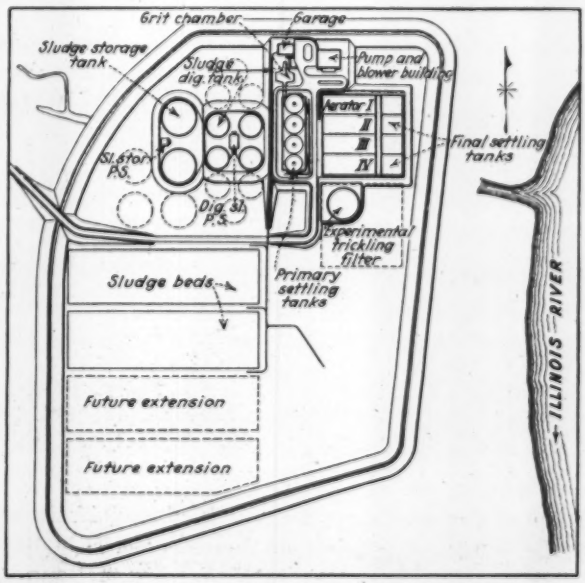
By Samuel A. Greeley

Of Pearse, Greeley & Hansen, Consulting Engineers, Chicago

THE activated-sludge process for presettled sewage, with separate digestion of heated sludge, and a small test sprinkling filter are the main features of the sewage-works now being constructed by the Peoria Sanitary District of Illinois. The district was formed June 6, 1927, and comprises the municipalities of Peoria, Averyville and Peoria Heights. The present population is 100,000 and the area 28 square miles. Bonds amounting to $2,415,000 were voted on Aug. 28, 1928, contracts amounting to $2,400,000 have been let, and completion is scheduled for the early summer of 1931. The main parts of the plant are: grit chambers, primary settling tanks, aeration tanks, final settling tanks, sludge-digestion tanks, sludge-storage tanks, sludge-drying beds and a small sprinkling filter.

The community at present is served with twenty sewers, mostly of the combined type, which discharge directly into the Illinois River or tributary streams along a waterfront of about 5½ miles. The intercepting sewer at its lower end is designed to serve 227,858 people at a daily per capita sewage-flow rate of 392 gal., or 89,400,000 gal. daily (89.4 m.g.d.). This requires a sewer 84 in. in diameter. Excess flows will go to the Illinois River through regulated overflows. The intercepting sewer will pass along and through railroad yards and warehouse districts and will not be of easy construction. Most of it will be built of reinforced-concrete pipe on a concrete cradle. Some tunnels will be lined with vitrified segmental blocks encased with concrete.

The intercepting sewer terminates in a pumping station in which will be located one 7-, one 14-, two 22- and one 33-m.g.d. vertical motor-driven pumps. The building will also house three blowers, one of 15,000- and two of 10,000-cu.ft. per min. capacity, for the aeration tanks, a laboratory and an office.



LAYOUT OF SEWAGE-WORKS FOR PEORIA SANITARY DISTRICT

CONTRACT PRICES FOR SEWAGE-WORKS OF PEORIA SANITARY DISTRICT

Structure	Total Cost	Unit	No. Units	Unit Price
Pump station and blower house	$184,465			
Grit-removal tanks	25,574	M.g.d.	50	$510 000
Primary tanks	99,091	Cu.ft.	165,000	0 600
Sludge-digestion tanks	199,058	Cu.ft.	660,000	0 300
Sludge-pumping station	61,502			
Sludge-storage tanks	106,684	Cu.ft.	850,000	0 125
Sludge-storage pumping station	17,228			
Sludge beds	106,755	Sq.ft.	280,000	0 380
Aeration tanks	224,036	Cu.ft.	776,000	0 289
Operating galleries	124,404	M.g.d.	22	5,660 000
Final tanks	88,003	Cu.ft.	231,000	0 381
Trickling filter	28,284	Acre-ft.	2 0	14,150 000
Outside piping	81,467			
Miscellaneous	111,024			
Electrical equipment	42,749			

The main plant is being built on low ground along the Illinois River in the southerly part of the district, where it is necessary to protect the site against floods by a ring levee, now complete, which makes available an area of about 50 acres. The sewage-works is designed for 140,000 human population at 100 gal. per capita per 24 hours, equivalent to 14 m.g.d., and 8 m.g.d. of industrial wastes.

A careful survey of the industrial wastes showed that during the winter of 1929 their population equivalent was in excess of 1,250,000. The present strength may be reduced by process adjustments at the industries and by changes in the character and routine of business. The amount of industrial wastes which may be handled will depend upon its strength and upon the most favorable operating routine. Therefore the plant is designed with more than the usual number of cross-connections and by-passes for flexible operation. The clarification works have capacity for the entire flow.

The primary settling tanks will provide a displacement period of 1.5 hours for 22 m.g.d. Four batteries of aeration tanks of the spiral diffusion type are each 70 ft. wide. Each flowing-through channel (three to a battery) is 5 ft. deep and 189 ft. long and will provide a displacement period of 10.5 hours for 11 m.g.d., in addition to capacity for 20 per cent return sludge. The final settling tanks will be 15 ft. deep and will provide 1 sq.ft. of tank surface for each 600 gal. per 24 hours at a flow of 11 m.g.d. With all of the present installation of blowers in operation, air can be delivered at the rate of 4.5 cu.ft. per gallon when the flow is 11 m.g.d. The blower room provides space for two additional blowers. The operation of the blowers and the unit quantity of air will be largely determined by the character of the mixed sewage from month to month, by the amount of water flowing in the river and by available funds.

As the industrial sewage may contribute large amounts of suspended matter, it has been deemed advisable to provide for sludge digestion and storage on a liberal basis. Four heated sludge-digestion tanks will have a total capacity of 660,000 cu.ft. and two unheated sludge-storage tanks a total capacity of 850,000 cu.ft. There are 280,000 sq.ft. of sludge-drying beds. The sludge-storage tanks, for use when sludge cannot be dried in the open, are being built with a light concrete bottom and an inside wall of sheet steel which is surrounded by 12 in. of reinforced concrete to take the earth pressure from the outside. These tanks are 130 ft. in diameter and 32 ft. deep.

The work of the Peoria Sanitary District is administered by a board of three trustees, for whom Pearse, Greeley & Hansen, Chicago, are engineers. John R. Longley is resident engineer in direct charge.

Special Cost-Plus Contract for River des Peres Drainage Canal in Rock

Analysis of a Cost-Plus Contract Adopted to Forestall High Bids Because of Hazards of Stream Control and Seepage—Special Stream-Diversion Conduits—Costs and Prices Analyzed

By W. W. Horner
Chief Engineer Sewers and Paving, St. Louis, Mo.

ABOUT 9,000 ft. of the River des Peres channel upstream from the earth sections described in the preceding article (*Engineering News-Record*, July 31, 1930, p. 176) was open canal in rock for part of full depth. This canal also followed the old stream quite closely and so involved stream-diversion problems in quite as large measure as did the canal in earth. This stream diversion constitutes the bulk of the following account of construction methods; there was little else which was exceptional.

The most important feature of the rock-canal operation was the successful trial of a cost-plus form of contract. As the most notable recent example of this form of contract for municipal public work, a statement of its general provisions and an analysis of the economic results are of particular interest.—EDITOR.

THE CANAL in rock included sections B2 and C, Fig. 1. Throughout their whole length of 9,000 ft., the bottom was in hard material, generally limestone, in which the cuts varied from 1 or 2 ft. up to 20 ft. At the extreme upper end of the work the rock changed to a shale, fireclay and sandstone mixture, occasionally with a cap ledge of limestone. Because of the uniformity of the industrial developments and of the material to be excavated, it was evident that one type of plant could be used to advantage throughout, and it was accordingly decided to contract the rock-bottom canal work in one unit.

The typical canal section is shown by Fig. 2. In several places where adjoining developments narrowed the right-of-way a section with vertical walls was necessary; the illustrations Figs. 3 and 4 show this special section.

Cost-Plus Contract Adopted

Virtually all of the canal construction in rock was along the existing stream, and was therefore subject to the same flood interference that had been experienced in the earth sections. Flood damage would not be so serious, however, since there would not be much erosion and the deposition of mud over the finished work would not be appreciable. The principal hazard was interference with progress, lost time for machinery and men and consequent increase in overhead cost.

At this time the recollection of the early work was still fresh in the minds of engineers and contractors. It seemed probable that these earlier impressions of flood consequences would inject a nervousness into the bidding that would be reflected in high prices. The engineers felt that the equitable thing was to arrange a form of contract that would pay for the flood damages if and when they occurred, and only if they occurred, rather than to take unit prices which would necessarily contain high items for flood expense.

A cost-plus contract of an extremely flexible type was devised. A detailed estimate of quantities on which bids were received was made. This schedule when revised by the final estimate constituted a base bid of cost. The actual final cost and expense were carefully kept. If this actual final cost equalled the final bid, the contractor received a fee of 10 per cent thereon. If it was less than the final base bid, the contractor received 10 per cent on the base bid plus one-third of the savings. If it was more than the final base bid, the 10 per cent fee was to be reduced in steps to a minimum of 5 per cent.

A $2,000 a week bonus and penalty on time of completion were provided. The contractor was to name the number of weeks in which he proposed to complete the work, and the bonus or penalty was to be computed on this time. The contractor naming the shortest time for the work would not have the bonus or penalty figure entered into his total, but to the bid of each of the other bidders there would be added a sum equal to $2,000 per

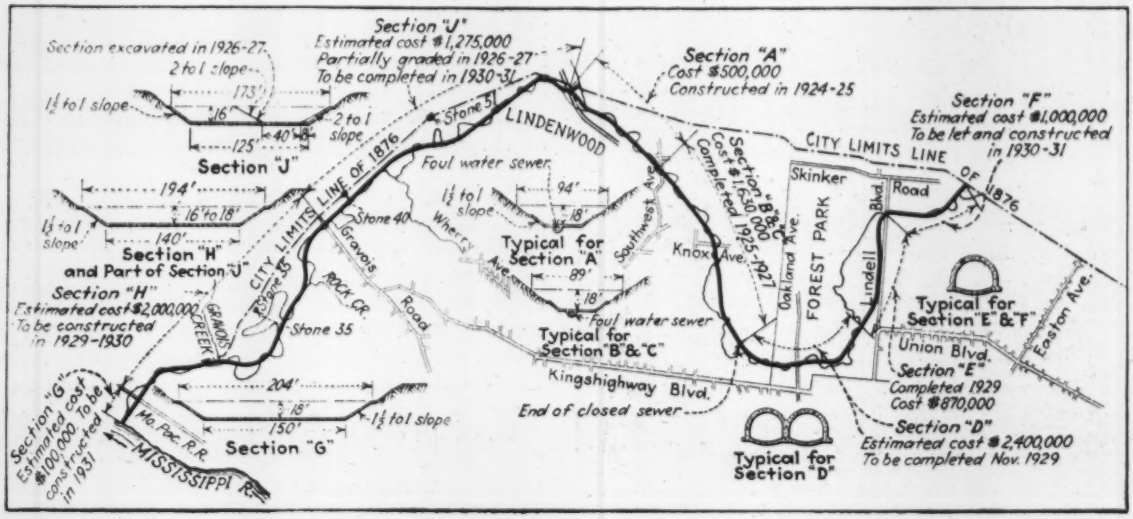


FIG. 1—OUTLINE MAP OF RIVER DES PERES DRAINAGE CHANNEL

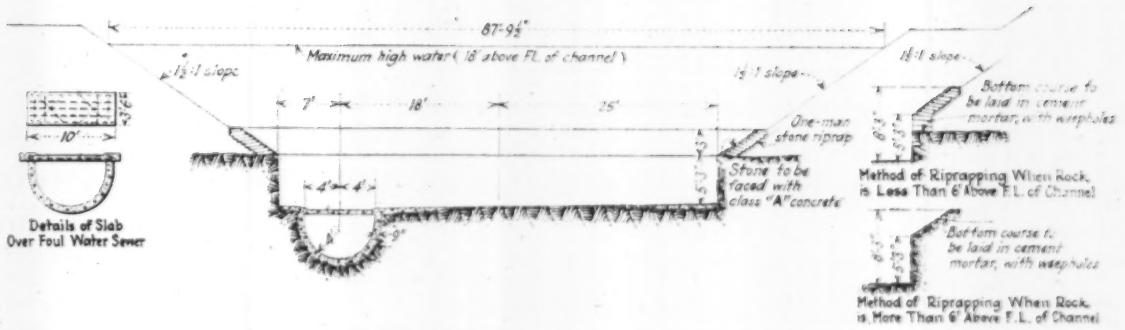

87'-9½"
Maximum high water (18' above Fl. of channel)
1½:1 slope
1:1 slope
1:1 slope
7'
18'
25'
10'
Details of Slab Over Foul Water Sewer
One-man stone riprap
Stone to be faced with class "A" concrete
4'
4'
9"
Bottom course to be laid in cement mortar, with weepholes
Method of Riprapping When Rock is Less Than 6' Above F.L. of Channel
Bottom course to be laid in cement mortar, with weepholes
Method of Riprapping When Rock is More Than 6' Above F.L. of Channel

FIG. 2—TYPICAL SECTION OF CANAL IN ROCK FOR RIVER DES PERES DRAINAGE

week for the number of weeks by which the time stated in their proposal exceeded the shortest time stated in any proposal. This made the proposals which carried the longer time of construction appear to be more expensive, a result which was economically correct. Provisions were made for progress payments, but no fees or bonuses were payable until the completion of the work.

The contract provided that cleaning up of mud and debris after each flood and taking out and replacing any partly completed work damaged by floods should be treated as a special expenditure, and the contractor would be paid the actual cost of it, including a prorated fraction of overhead and general expense, and a profit of 10 per cent. Also, as the work had to be done immediately adjacent to the main tracks of two trunk-line railroads, special provision had to be made to protect their traffic, and it was provided that the contractor would be reimbursed for these expenses in the same manner as for flood damage.

There was omitted certain work in connection with bridges which was still at that time in negotiation with the railroads, and it was provided that if this work was done it would be added work and would be paid for at actual cost in some instances and at contract prices in others. All of this work was actually done, and the expense is shown in Table I as added work.

During construction some further studies were carried out as to dilution factors affecting the capacity of the sanitary sewer, and it was decided to increase the size and capacity of this sewer throughout the upper mile of this contract; the change was made and the increased cost due to this change is part of the added work item in the final estimate.

Analysis of Bids and Costs

The construction involved about 425,000 cu.yd. of earth excavation, 175,000 cu.yd. of rock and hardpan, 500,000 sq.ft. of riprap paving, 150,000 cu.ft. of concrete, some channeling and a large amount of line drilling to produce a smooth rock face. There was about 9,000 ft. of foul-water sewer, besides the construction of retaining walls, lateral sewers, bridge piers and miscellaneous structures.

The city's estimate of cost is the first line in Table I. The element of time was not valued, but the department estimate was about 70 weeks. It is interesting to note that the average of the six bids for the base cost was almost exactly the city's estimate. The shortest time

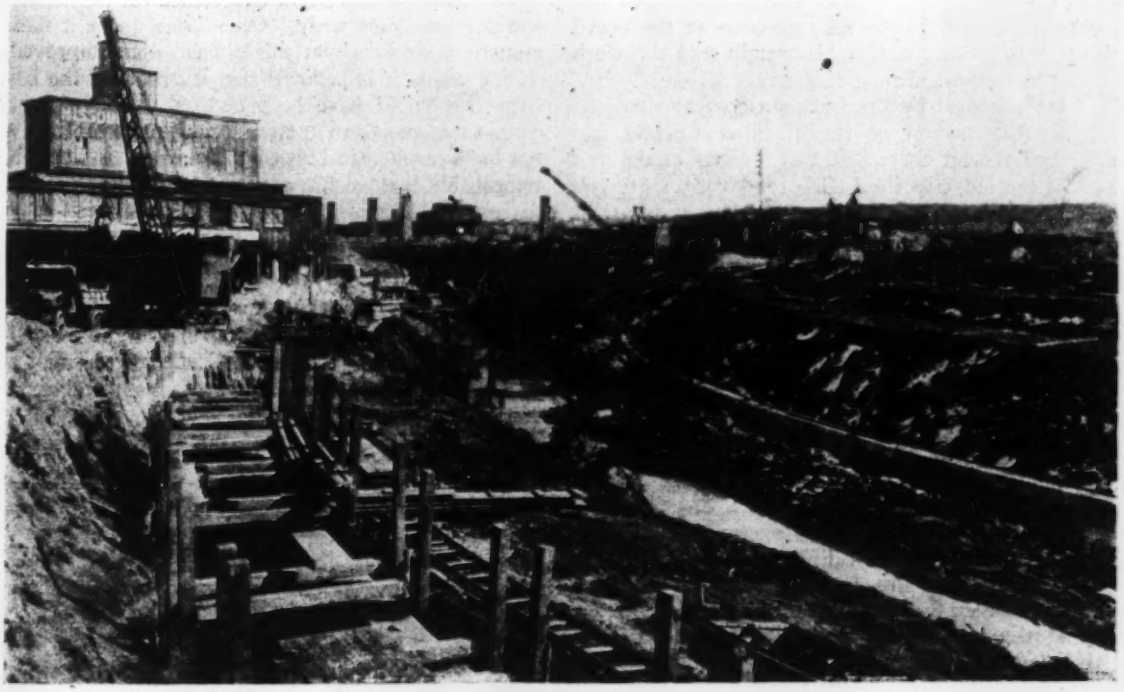


FIG. 3—CANAL WITH RETAINING WALLS UNDER CONSTRUCTION

named was 52 weeks. The city's estimate of $100,000 for special flood and railway expenditures is added to the average and to the Callahan bid, and an arbitrary estimate of five weeks of $10,000 seemed to about cover the expectations as to time.

The bids required detailed analysis, as it was obvious that the low bid would not necessarily produce the cheapest and most economical result for the city. Each bid was studied as to the outcome under the various conditions of final cost and final time. Strangely enough, under almost every possible assumed condition, the proposal of the next to low bidder, which was A. Guthrie & Co., appeared to give the lowest final cost to the city. However, the differences under all these assumptions between the results under this bid and that of the W. E. Callahan Construction Co., which put in the lowest base bid, were small, and in the final decision of the board precedent was given considerable weight and the work was awarded to the Callahan company.

The time specified by the Callahan company was 85 weeks, whereas several of the other contractors had named much shorter times. It was obvious in the first analysis of the bid, that the Callahan company's greatest probability of profit lay in the time bonus, and this actually resulted as is shown in the final figures. Analyzing these results in more detail, it will be noted that the final value of the base quantities was $77,000, or about 8 per cent more than the city's estimate; however, it was $270,000 more than the Callahan company's estimate for doing the work. As a partial offset to this, the company lost and the city saved nearly one-half of the expected fee.

The city's estimate of special work was about right, but the added work and the small amount of extras increased the final estimate considerably. The final estimate was about 16 per cent in excess of the city's original estimate, but of this difference nearly half was included in the items already mentioned that had been deliberately omitted from the formal contract. The completion of the work in 61 weeks instead of 85 weeks and the consequent possibility of speeding up the succeeding contracts fully justified the $48,000 time-bonus expense.

Some of the unit costs are of general interest and are as follows:

Item	City's Estimate	Contractor's Base Bid	Actual Cost
Solid rock excavation, 125,000 cu.yd.	$2.50	$1.45	$1.38
Excavation, 460,000 cu.yd.	.45	.40	.47
Riprap paving, 270,000 sq.ft.	.10	.09½	.42½
Channeling, or drilling and broaching, 60,000 sq.ft.	.55	.71 .36	.18
Gunite in place per sack of cement, 17,000 sack	2.25	2.70	1.57

It was on the construction of the foul-water sewer, which was taken at a price per linear foot complete in place, that the estimates were found to be badly in error. The city's estimate on the 9,000 ft. was $18 per foot; the contractors' estimates under various conditions were from $6.55 up to $15; the final cost was about $26.

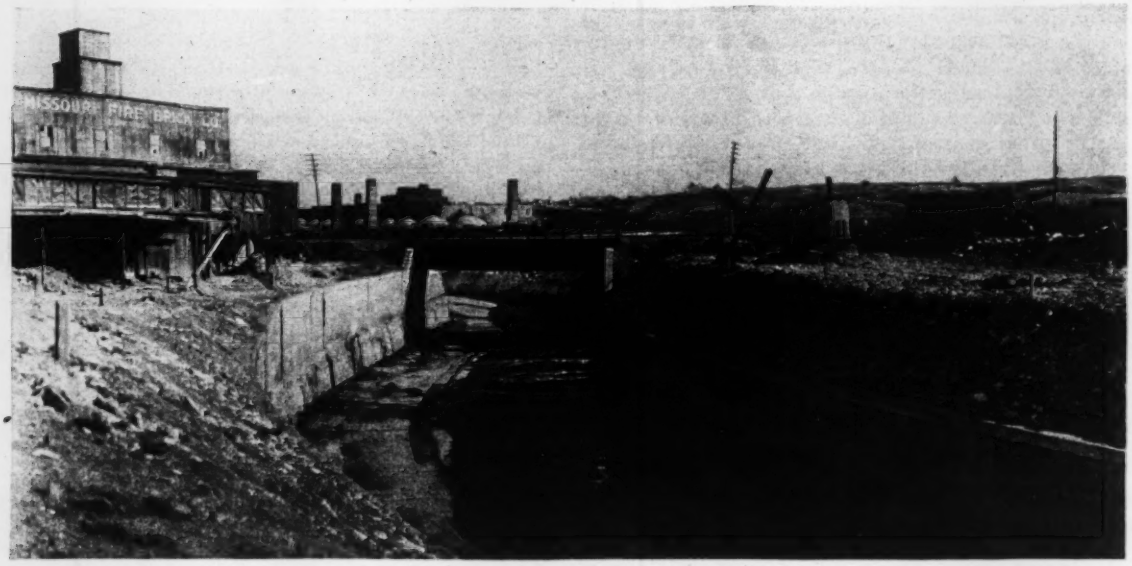


FIG. 4—COMPLETED RETAINING-WALL CANAL

This contract was a new experience for the department and for St. Louis work. Operations under it indicated numerous sections that might have been improved, but on the whole it is believed that it produced the best results that could have been secured. The writer feels certain that any form of straight unit-price contract would not have resulted in bids of this amount and it is highly improbable that such a contract would have secured as early completion.

Construction Methods

Work started in July, 1926, and was completed in October, 1927. Stripping was done with dragline excavators. In general the rock was drilled and blasted over a considerable length and was loaded by a small shovel in the trench onto light railway cars and taken out on ramps.

After a small amount of the foul-water sewer had

TABLE I—OPERATION UNDER COST-PLUS CONTRACT FOR RIVER DES PERES DRAINAGE WORKS

Item	Base Cost	Special Expenses	Fee	Time Bonus	Total Expenses
City estimates	$925,000	$100,000	$92,500	.....	$1,117,500
Average of six bids	926,900	100,000	92,690	$10,000	1,129,590
Callahan bid	730,923	100,000	73,000	30,000	933,923
Final cost	1,003,049	[1]04,000	46,022	48,000	1,201,071
Added work	.....	108,233	.....	.....	108,233
Extras	.....	27,000	.....	.....	27,000
Total	.....	$239,233	.....	.....	$1,336,304

been constructed it was evident that the use of segment block lining in rock cuts was not the most economical construction. A revised section providing for a concrete lining placed against the roughly excavated sides of the rock trench was adopted and the contractor's base price was proportionally reduced.

The diversion of the creek was generally the governing consideration. For the first 2,000 ft. a diversion ditch was practically impossible and the contractor was given permission to lay a reinforced-concrete pipe about 5 ft. in diameter on the bottom of the creek and immediately to one side of the finished work in order that the dry-weather flow might not interfere with the rock excavation. Several other forms of stream diversion were employed. In one instance the construction of a full-size channel would have involved the filling of the creek and diversion ditch with the spoil, and the channel was excavated for half the width. The low-level sewer was then constructed and put into service to carry the creek while the remaining half was excavated and dumped in the original diversion channel. In another instance no diversion of any kind was possible. The rock excavation was carried down in alternate steps, one-half width at a time, the creek flow being carried in the opposite half behind a rockfill and sandbag barricade. When the first half reached finished grade, the low-level sewer was constructed in it. The remaining excavation and the guniting of the sides were then possible in the dry periods between rains.

In the next stage upstream under somewhat similar conditions, the creek flow was carried in a concrete box built into one of the retaining walls and constructed before the rock excavation was started. The retaining-wall sections were used to meet conditions where taking sufficient land for side slopes would have seriously crippled abutting industries and involved extraordinary damages.

For the last 1,000 ft. of the work the new channel lay in the existing creek and was confined narrowly between the railroad right-of-way and a steep hill. Here the dry-weather flow was taken care of by building the low-level sewer as a tunnel under the future side slope. This tunnel was constructed before the main operations reached this vicinity. Its use for the dry-weather flow and a fortunate spell of weather comparatively free from heavy rains provided a satisfactory outcome for what had been expected to be one of the most difficult operations.

Construction of the concrete conduit sections will be described in a concluding article.

Special Steel Reduces Weight of 935-Ft. Girder Bridge

Single Span of 377 Ft. Part of German River Crossing—High Tensile Strength Reduces Plate Thickness

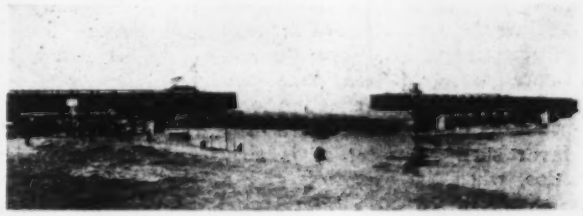


FIG. 1—ERECTING STEEL FOR GERMAN BRIDGE

WITH a maximum unsupported central span of 377.29 ft., a 935-ft. continuous deck-plate girder bridge now nearing completion over the River Elbe near Dresden, Germany, is of unusually light construction, due to the use of corrosion-resisting steel of high tensile strength. Besides the central span, the structure consists of two side spans 213.25 ft. long and a single span with a length of 131.23 ft. It has a total width of 55.8 ft., including a 36-ft. roadway and two sidewalks.

As is shown by Fig. 2, the main framework consists of three plate girders spaced 14.8 ft. on centers, the sidewalk and a small portion of the roadway being cantilevered out on brackets. In depth these girders vary from 16.4 to 18 ft., with a further increase to 24.6 ft. at the two piers adjacent to the long span. The thickness of the girders is remarkably small, owing to the physical properties of the steel used. It varies from 0.75 in. near the pier to only 0.59 in. at the center of all four spans. Additional reinforcement is provided by stiffening angles at intervals of 7.4 ft. Ample cross-bracing is also provided, with floorbeams at 14.8-ft. intervals.

The entire structure requires only 2,600 metric tons of the special corrosion-resisting St 52 steel made by the Mitteldeutsche Stehlwerke, a subsidiary of the United Steel Works. This has a tensile strength varying from 78,400 to 82,600 lb. per square inch. Each girder is made up of single pieces with a length of 49.2 ft. weighing from 14.3 to 15.5 metric tons each, according to width and thickness. Construction methods used for the piers and for the bridge itself are conventional. Contracts were awarded in May, 1929; the piers were finished in November of that year, and the opening of the structure is expected to take place in 1930.

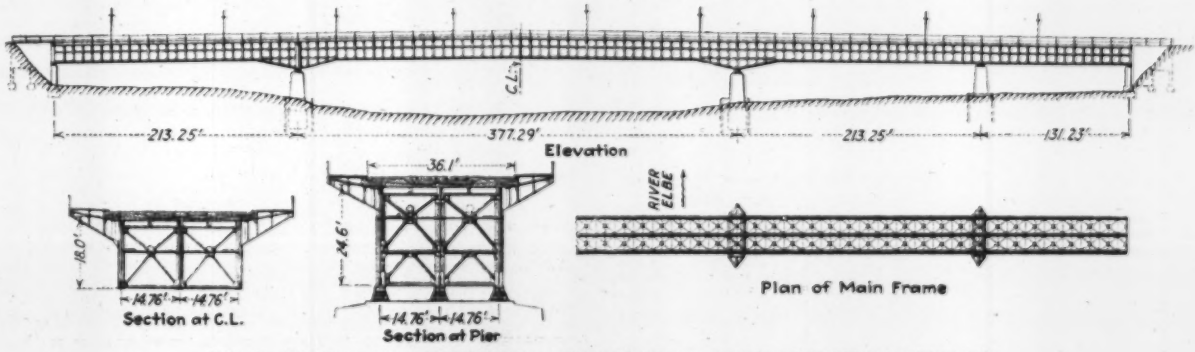


FIG. 2—FOUR-SPAN CONTINUOUS DECK-PLATE GIRDER BRIDGE IN GERMANY

Solving Cubic and Quartic Equations

Development of a Practical Method for Use in Every-Day Structural Design

By F. T. Llewellyn
U. S. Steel Corporation, New York, N. Y.

EQUATIONS of the third and fourth degree do not arise very frequently in the course of structural design, but when encountered they are important and must be solved with certainty and dispatch. The common opinion among structural engineers, and perhaps in other branches of applied science, is that the required root of most cubic and of all quartic equations occurring in practice can be found by trial more advantageously than by any direct method, whether special or general. The purpose of this article is to show that direct or so-called academic methods may be put in such form as to be of quite practical utility.

During the past few years the writer needed to solve a number of equations of this character. In doing so he confirmed the prevailing impression that the application of academic method, in its published form, could be effected only after considerable trouble, but he also concluded that the ordinary trial method was not satisfactory. Attempts to analyze the causes of difficulty attending the application of academic rules suggested their rearrangement in a form that, so far as his own experience goes, greatly facilitates their use.

In the type of equation encountered in structural problems the coefficients are usually too cumbersome to favor such treatment as is given in school examples. Also, when the textbooks give more elaborate general methods, based on Cardan's elimination of the second term, they are expressed with a brevity that is not immediately clear, having been arranged primarily to show their origin rather than to make them immediately useful. Another drawback to the employment of any direct method has been the uncertainty that arises at intermediate steps as to the precision needed in order to obtain a final result that shall be accurate within a required tolerance. Magnitudes of force computed to three significant places, insuring accuracy within 1 per cent, are usually as close as can be reflected in available sources of power or cross-sections of material. As regards locational dimensions, an accuracy closer than hundredths of an inch is neither useful nor attainable with bridge-shop tools.

On the other hand, a trial method is always accompanied by an unsatisfactory sense of groping. For example, the writer recently had occasion to review a quartic equation occurring in the design of swing bridge machinery. The trial method had given a single value that checked closely enough for all practical purposes. Upon applying a textbook method two positive real roots were disclosed, one of which approximated the trial value while the other was about one-twentieth of that value. To an engineer with previous experience in the subject the adoption of the lesser value in this particular case would be manifestly absurd, but the absurdity would not be so obvious in a new problem, or in one where the roots lay nearer together. In such cases, a likely-looking but improper value might have been the one found by trial, and unless checked by some other means the resulting design would be either too weak or unnecessarily strong.

The practical need is not for additional research on the part of mathematicians, for they have provided ample apparatus, but rather for a single direct working method, of universal scope, so arranged that it can be applied with sufficient accuracy by any computer who has a sound knowledge of elementary mathematics and is familiar with the use of tables.

With the aim of securing such a set of rules the writer has assembled those general formulas which he has found to be most workable, and after suitably adjusting coefficients and signs has arranged them in a series of steps that lends itself, with a minimum of labor, to practical use. Clues to derivation have been omitted as tending to cause undesirable distraction, but the authorities listed at the end of the article will permit pertinent references to be traced. The rules, which are presented herewith, have been tried out in a large number of miscellaneous problems. The computations were made in about the same time as would be required to find one root by a reasonably close trial method, with the added advantage that all the roots, real and complex, were determined by means that provide a complete check. Moreover, the work of computation was not clouded by doubt as to the

RULES FOR THE SOLUTION OF CUBIC AND QUARTIC EQUATIONS ARRANGED FOR PRACTICAL USE IN STRUCTURAL PROBLEMS

Cubic Equations*

1. Put equation in form: $y^3 + 3Ay^2 + 3By + C = 0$.
2. Tabulate values of A, B and C in terms of the coefficients of the problem in its general form.
3. Determine values of q and r in terms of the coefficients of the problem in its general form, where $q = (B - A^2)$ and $r = \left(\frac{3}{2}AB - \frac{1}{2}C - A^3\right)$
4. Compute numerical values of q and r, and call them $+Q$ and $+R$, respectively, regardless of their actual signs.
5. Select applicable case, I, II or III, by step 7.
6. Compute u by step 8, and thence z by step 9.

Applicable Case	I	II	III
7. If q is	Negative	Negative	Positive
and Q^3 is	$\geq R$	$< R$	Any
8. $R \div Q^{\frac{3}{2}} =$	$\cos u$	$\cosh u$	$\sinh u$

9. $Z = \frac{r}{R}Q^{\frac{1}{2}}$ multipled by $2\cos(1/3u)$ $2\cosh(1/3u)$ $2\sinh(1/3u)$
10. Find the three roots y of equation in cubic step 1 from: $y_1 = Z - A$; y_2 and $y_3 = -\frac{1}{2}(3A + y_1) \mp \sqrt{\frac{C}{y_1} + \frac{1}{4}(3A - y_1)^2}$
11. Check: $y_1(y_2 + y_3) + y_2y_3 = 3B$.

Quartic Equations*

1. Put equation in form: $x^4 + ax^3 + bx^2 + cx + d = 0$.
2. Tabulate values of a, b, c and d in terms of the coefficients of the problem in its general form.
3. Compute numerical values of $\frac{1}{4}a$, $\frac{1}{4}a^2 - b$, $\frac{1}{4}b$, and d, with signs.
4. Determine values of q and r in terms of the coefficients of the problem in its general form,
   where $q = (\frac{1}{8}ac - 1/9\ b^2 - 4/3d)$ and
   $r = (\frac{1}{16}a^2d - \frac{1}{8}abc + 1/27b^3 - 4/3\ bd + \frac{1}{8}c^2)$.
5. Proceed as in cubic steps 4 to 9. Then $y = Z + \frac{1}{4}b$.
6. Find the four roots x of equation in quartic step 1 from: $x^2 + x(\frac{1}{2}a \mp \sqrt{\frac{1}{4}a^2 - b + y}) = -\frac{1}{2}y \mp \sqrt{\frac{1}{4}y^2 - d}$
   Pair like radical signs when $(\frac{1}{8}ay - c)$ is negative.
   Pair unlike radical signs when $(\frac{1}{8}ay - c)$ is positive.
7. Check: $x_1x_2x_3x_4 = d$.

*Caution: Errors in sign are most apt to occur in cubic steps 1 to 3 and quartic steps 1 to 4. These should be rechecked. In practical problems q and r usually reduce very simply, prior to cubic step 4, by bringing terms to common demonimators.

selection of a suitable method or as to the interpretation of formulas.

It is believed that these rules will suffice for the direct solution of any algebraic equation of the third or fourth degree, with the negligible exception of the cube and the bi-quadratic of $x + k = O$. Here Q equals zero and consequently cubic step 8 becomes indeterminate. Such equations are of course solvable by inspection.

It is not always necessary to take all the steps given in the rules. For example, there is a class of cubic equations that are met with occasionally in problems relating to elastic deformation wherein an unsought root y_1 is self-evident. Manifestly in such cases the root sought, y_2 or y_3, can be determined at once from cubic step 10 without going through steps 3 to 9.

Solving a Cubic With No Roots Known—Figs. 1 and 2 illustrate the solution of a cubic equation where no root is known. It is desired to find the flange thickness of a beam section (Fig. 1) that will give the greatest efficiency per unit of an area about its major axis *1-1*, the depth d, width b, and web thickness t being given.

Here the flange thickness sought $= \frac{1}{2}(d - y)$. It is convenient to let $2a = b - t$ so that the area $= db - 2ya$.

$I_1 = 2nd$, and Moment $_{1\text{-}1} = 1/12\ (d^3b - 2y^3a)$

$$\text{Efficiency per unit of area} = \frac{I}{\text{Area}} = \frac{d^3b - 2y^3a}{12db - 24ya}$$

Maximum (or minimum) efficiency occurs when the first derivative with respect to y equals zero—that is, when

$$y^3 - \frac{3dby^2}{4a} + \frac{d^3b}{4a} = O$$

Applying the cubic rules given herewith

$$A = -\frac{db}{4a},\ B = O,\ C = \frac{d^3b}{4a}$$

$q = -\frac{d^2b^2}{16a^2}$, which is negative. $r = \frac{d^3b^3}{64a^3} - \frac{d^3b}{8a}$

In a section where $d = 24$, $b = 9.75$, $t = 0.405$, $2a = 9.345$

$\frac{r}{R} = -1$, $Q^{\frac{1}{3}} = \frac{db}{4a} = 12.52$, $A = -12.52$, $C = 7{,}211.52$

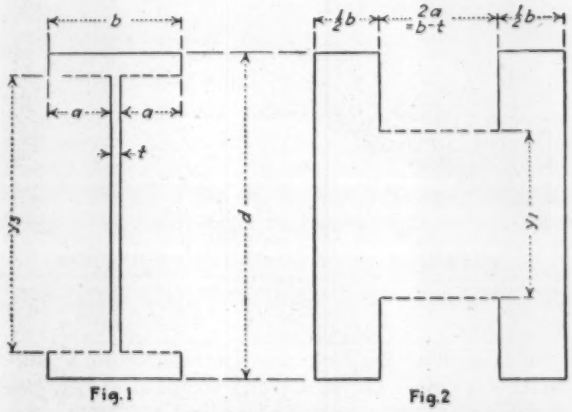
$R \div Q^{3/2} = \frac{8a^2}{b^3} - 1 = 0.8373$, so that Case I applies.

$0.8373 = \cos u$ and $u = 0.579$ radians

$1/3\ u = 0.193$ radians. $\cos\ (1/3\ u) = 0.98143$

$z = -1\ (12.52)\ (1.96286) = -24.576$

$y_1 = -24.576 - (-12.520) = -12.056$



SOLVING A CUBIC EQUATION, NO ROOT KNOWN

Substituting this value in the ordinary quadratic equation, cubic step 10: $y_2 = +28.96$ $y_3 = +20.65$. These check with step 11. Evidently y_3 is the value sought, and this indicates that a flange thickness of $\frac{1}{2}\ (24 - 20.65) = 1.675$ will give the maximum efficiency per unit of area.

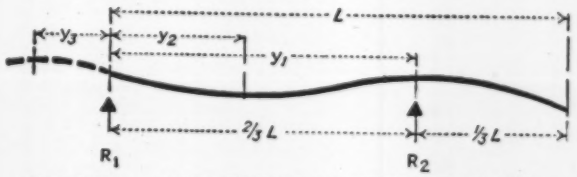
The unsought roots, y_1 and y_2 exemplify the fact that any equation formed to express relations in a given problem is broader in scope than the problem that gave it birth. For example, the root y_1 indicates that the minimum efficiency of an H-section, with constants rearranged as in Fig. 2, occurs when the web is 12.056 thick. We asked the equation to tell us what dimensions would give maximum efficiency in a beam. It has done so, and for good measure it also indicates the dimensions that will give minimum efficiency in an H-column. A similar generosity of response permeates all fields of applied mathematics.

In order to realize the signification of the root y_2, both numerator and denominator of the $\frac{I}{\text{Area}}$ equation must be multiplied by (-1), when it is seen that the maximum efficiency indicated refers to the difference between the properties of two rectangles. These rectangles cannot be combined to form the diagram of a structural section, the greater having a width $= 2a = 9.345$ and a depth $y_2 = 28.96$, and the lesser having a width $= b = 9.75$ and a depth $= d = 24$.

Solving a Cubic With One Root Known—Fig. 3 illustrates the solution of a cubic equation where one root is known. A beam, whose length $= L$, is supported as shown. It carries a uniform load per unit of length. The magnitude of its deflection at any point involves the distance y of its point of intermediate tangency from R_1, the formula in this example being

$$y^3 - \tfrac{3}{4}Ly^2 + 1/27\ L^3 = O$$

This could be solved as cubic, but several steps may be saved by noting that in Fig. 3 one point of tangency occurs at R_1.



SOLVING A CUBIC EQUATION, ONE ROOT KNOWN

Therefore as one root, $y_1 = \frac{3}{4}L$. Inserting this value in cubic step 10, where $A = -\frac{3}{4}L$ and $C = 1/27L^3$, an ordinary quadratic ensues with the two roots

$$y_2 = \frac{L}{24}(1 + \sqrt{33}) = 0.281\ L;$$

$$y_3 = \frac{L}{24}(1 - \sqrt{33}) = -0.198\ L$$

Checking by cubic step 11, where $B = O$:

$$2/3\ L\left(\frac{L}{24}(1 + \sqrt{33} + 1 - \sqrt{33})\right) + \frac{L^3}{576}(1 - 33) = O$$

The three values of y occur respectively at R_2, at a point $0.281L$ to the right of R_1 and at a point $0.198\ L$ to the left of R_1. The third value is not applicable to the problem in question. It locates a point of tangency on an imaginary extension of the elastic equation.

Evidently $y_2 = 0.281\ L$ is the value sought.

A Quartic Equation Example—Following is illustrated an application of the quartic rules to the swing bridge problem referred to above where the trial method had given a value of 68,700 lb., which proved to be within 0.04 per cent of the true x_1. The illustration discloses also another real root x_2 having a value of 3,485 lb., as well as two complex roots x_3 and x_4. The signification of both of the real roots is made clear by reference to the origin of the equation in question. The complex roots provide a convenient check.

The example occurs as Problem B2, to illustrate equation 7, in Chap. II, Vol. II, of Hovey's book on "Movable Bridges." It is desired to find the rack force x that is needed to open a span in minimum time, where P = motor horsepower, M = equivalent mass of span, C_1 = distance traveled by pinion, R_1 = frictional resistance due to bearing, f = frictional factor in transmission from motor. We here substitute C_1 for Hovey's symbol C on account of C being a general symbol in our rules. The symbol R_1 used in equation 7 must not be confused with the general symbol R in the rules.

$$\text{Let } F = 1 - f^2, \text{ and } N = \frac{550^3\ P^3\ M}{C_1}$$

$$\frac{Fx^2 - 2f\ R_1x - R^2_1}{\sqrt{Fx - fR_1}} = \sqrt{2N} \qquad \text{(Eq. 7)}$$

Square, collect and divide by F^2:

$$x^4 - \frac{4\ fR_1}{F}x^3 - \frac{2(1 - 3f^2)R_1^2}{F^2}x^2 - \left(\frac{2N}{F} - \frac{4fR_1^3}{F^3}\right)x + \left(\frac{R_1^4}{F^2} + \frac{2f\ R_1\ N}{F^2}\right) = 0 \qquad \text{(Eq. 7A)}$$

Here $q = \frac{-16R_1^4}{9F^4}$; $r = \frac{2N^2}{F^2} + \frac{64R_1^6}{27F^6}$; $Q^{\frac{1}{3}} = \frac{4R_1^2}{3F^2}$; $\frac{r}{R} = +1$

$R \div Q^{3/2} = \frac{27N^2F^4}{32R_1^6} + 1$; Therefore, Case II applies

So far, the solution has been general. In Problem B 2:

$R_1 = 12{,}590$; $M = 820{,}523$; $C_1 = 29.335$

$P = 119$; $f = 0.25$;

AUTHORITIES CONSULTED

Title	Author	Publisher	Edition	Reference	Location
The Solution of Equations	Mansfield Merriman	John Wiley & Sons, New York	1906	Separation of the roots	pp. 8-10, Art. 5
Graphic Algebra	Arthur Schultze	The Macmillan Co., New York	1908	Solution graphs	Throughout
Smithsonian Mathematical Tables	Becker and Van Orstrand	Smithsonian Institution, Washington	1909	Solution of the cubic	pp. 26-27
				Tables of hypes	Throughout
First Course in the Theory of Equations	L. E. Dickson	John Wiley & Sons, New York	1922	Expressions for q and r	p. 52, formula 20
Higher Algebra	Fisher and Schwatt	The Macmillan Co., New York	1924	Relation between roots and coefficients	p. 562, Art. 10
Transmission Circuits for Telephonic Communication	K. S. Johnson	Van Nostrand, New York	1927	Solution of the cubic and bi-quadratic	Appendix A, pp 248-9
Funfstellige Tafeln der Kreis, und Hyperbelfunktionen	K. Hayashi	Walter de Gruyter & Co., Berlin	1928	Tables of hypes (convenient for slide-rule use)	Throughout

$\frac{1}{3}a = -\frac{8R_1}{15} = -6{,}714.7$; $\frac{1}{3}a^2 - b = \frac{32R_1^2}{15} = 338{,}150{,}600$

$\frac{1}{3}b = -97{,}687{,}950$; $d = \frac{128}{225}(2R_1^4 + N) = 8{,}867{,}643 \times 10^{11}$

$R \div Q^{3/2} = 2{,}350.59 = \cosh u$; $u = 8.45557$

$\frac{1}{3}u = 2.81852$;

$2 \cosh (\frac{1}{3}u) = 16.8118$;

$\log Q^{\frac{1}{2}} = 8.3810476$

$Z = 4{,}042{,}606{,}500$; $y = 3{,}944{,}918{,}600$

$\sqrt{\frac{1}{4}a^2 - b + y} = 65{,}445.1$; $\sqrt{\frac{1}{4}y^2 - d} = 1{,}733{,}156{,}500$

$x^2 + x\,(-6{,}714.7 \mp 65{,}445.1) = (-1{,}972{,}459 \pm 1{,}733{,}156)\ 10^3$

Using upper signs:

$[x - 36{,}079.9]^2 = [-239{,}303 + 1{,}301{,}760 = 1{,}062{,}457]\ 10^3$

$x = 36{,}079.90 \pm 32{,}595.35$

$x_1 = 68{,}675.25$ = force needed to open span in minimum time, i.e., 45 sec.

$x_2 = 3{,}484.55$ = force needed to open span in maximum time, i.e. just to move the span.

x_1 and x_2 satisfy equations 7 and 7A

Using lower signs:

x_3 and $x_4 = -29{,}365.2 \pm 53{,}322.5\ \sqrt{-1}$

x_3 and x_4 satisfy only equation 7A

Check: $x_1\ x_2\ x_3\ x_4 = (8{,}867{,}618) \times 10^{11} = d$ within 0.0003 per cent.

Thus it is seen that the original equation 7, which is of the second degree but insoluble as a quadratic on account of its radicals, has two real roots, each of which represents a tangible characteristic. After squaring it into the solvable form 7A, which is of the fourth degree, the same two real roots apply, and in addition two complex roots appear. The imaginary term in the complex roots is to be expected as a result of the previous squaring operation.

It is impracticable to forecast the precise degree of accuracy attainable by given means for the reason that the rules involve sums and differences of quantities whose ratio is apt to vary. Some indication is given by the swing-bridge example where differences between quite large quantities occur. Here all computations were made with the aid of seven-place logarithms, with the result that x_1 is correct to seven places and the product of the roots checks within 0.0003 per cent. The same problem was recomputed by means of a slide rule and Hayashi's five-place tables, and this gave a value for x_1 of 68,656 lb., which is correct to three places and is within 0.02 per cent of the true magnitude. The writer has not come across a single practical case wherein a degree of accuracy more than sufficient for any structural problem was not attainable with five-place tables. He would expect that the logarithmic and natural tables of hyperbolic functions prepared at the Smithsonian Institution or the more recent natural tables prepared by Hayashi will usually be found adequate. In any ordinary case sufficient accuracy will be secured by assuming that hypes intermediate between those tabulated are proportional, and when u is greater than 6 radians that $2 \cosh u$ and $2 \sinh u$ are each equal to e^u.

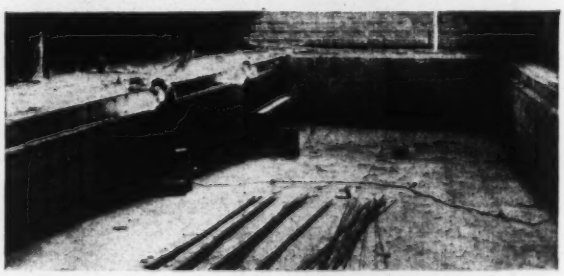
Two features in the detailed steps are to be noted. The computation resulting from quartic step 4 looks as if it might become rather messy, but in practice no general equation has been encountered by the writer wherein, prior to numerical substitution, the expressions for q and r failed to reduce to one or at most two terms, thereby greatly decreasing labor and enhancing accuracy. This is exemplified in the formidable looking swing-bridge problem. The writer doubts whether this feature has been observed hitherto.

The second feature concerns the alternative signs of the radical in both members of quartic step 6. The textbooks appear to indicate that upper signs go together and lower signs go together. The writer has not found this rule to hold universally. It does not in the cited swing-bridge equation. The writer has derived a simple basis for pairing these signs which is incorporated in the rules.

Arc-Welded Steel Swimming Tank

THE new home of the National Town and Country Club at Cleveland, Ohio, contains a large swimming tank fabricated completely by the electric arc-welding process. This tank, which holds approximately 300 tons of water, extends from the fifth to the fourth floor of the building. It is 75 ft. 8⅞ in. long and 25 ft. 7¾ in. wide, with depths at the two ends of 3 ft. 8¼ in. and 8 ft. 8¼ in. The deepest part measures 9 ft. 8⅜ in.

Approximately 43 tons of steel was used in building the tank, according to the Lincoln Electric Co., which has furnished the data for this note. The sides and floor are of ⅜-in. steel plate, and the outside stiffeners are 6-in. H-beams and 4-in. I-beams. The bottom is supported



SWIMMING TANK DURING CONSTRUCTION

by 18-, 20- and 24-in. I-beams which are part of the superstructure of the building.

In fabricating the tank it was necessary to make 2,400 lin.ft. of welds. The steel plates were lap-welded except at the corners and where the floor and wall meet. As an additional precaution against leakage and to secure further rigidity, the laps were welded on both sides. On the inside of the tank small squares of steel plate were welded in place 18 in. apart, as shown in the illustration. Steel rods were welded to these squares both across the bottom of the tank and up the sides, in order to hold the finishing material in place. This consisted of a 4-in. coat of gunite to which was cemented a tile lining.

Welding on the tank was done by the John L. Frazier & Sons Co., of Cleveland. The Thompson-Starrett Co., New York City, was the general contractor.

High-Capacity Track Scale for Weighing Locomotives

New Haven Railroad Installs Large Scale of Two-Section Type—Each Section Is of 200 Tons Capacity

THE largest high-capacity two-section track scale yet built has been installed by the New York, New Haven & Hartford Railroad at Readville, Mass., for the purpose of weighing locomotives. For a two-section scale it has the unusual feature of a weigh-rail length of 75 ft., and each section is of 200 tons capacity. No dead rail is used. Four main levers, two end extension levers and a transverse lever to the beam rod constitute the lever system. Cast steel is used for the main levers and cast iron for the others. Alloy steel knife-edges and bearings have an allowable loading of 6,000 lb. per linear inch, and the alloy for the main suspension links has an ultimate strength of 105,000 lb. per square inch. The scale bridge is shown in Fig. 1 and the general arrangement of bridge and levers in Fig. 2.

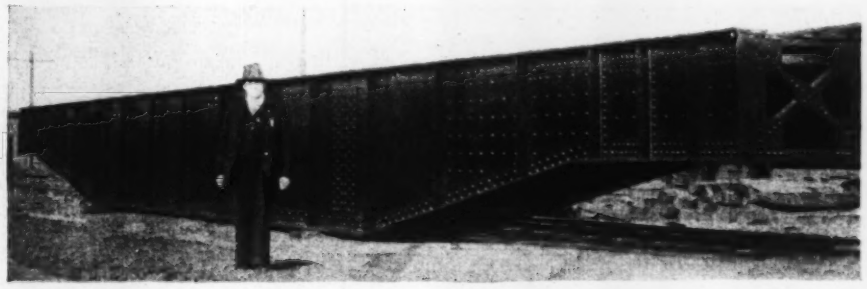


FIG. 1—GIRDERS FOR 75-FT. TRACK SCALE

This scale bridge, designed for locomotives of E-70 loading, consists of a pair of 75-ft. fish-belly plate girders, 7 ft. 3 in. deep at the middle and 4 ft. at the ends, with extra cover plates at top and bottom in the middle third of the span. At sections of maximum shear, this shear is kept well below allowable limits to insure against loose rivets. To reduce the weight and the clear span as well as to shorten the end levers and to reduce vibration, there is an overhang of 5 ft. at each end. This exceeds the 3-ft. limit of the A.E.R.A. specifications, but tests have shown satisfactory results, and these, together with the economy in material, are considered sufficient to warrant this construction in spans of such length. Bumper checks on the ends of the bridge transmit thrust to it as a compressive force. Checks for transverse or lateral movement are also provided.

Two-section track scales have been used mainly at steel mills and other industrial plants, their sectional capacity rarely exceeding 100 tons and the effective length of weigh rails ranging from 10 to 30 ft. A special form of two-section scale for standardizing the weight of railway scale-test cars is of 50 tons section capacity, with weigh rails about 12 ft. long. Specifications for two-section knife-edge track scales, without dead rails, as prepared by the yards and terminals committee of the American Railway Engineering Association, were adopted by that association in 1927, supplementing its earlier specifications for four-section scales with dead rails. These new specifications provide for capacities of 200 and 150 tons per section.

In many older scales for weighing cars the table had a dead rail for a track gantleted with the scale track to enable locomotives to be run across the scale without affecting the weighing mechanism. This is said to have been done partly on account of heavy driving-wheel loads but mainly because tractive forces acting longitudinally through the articulated bridge were assumed to be greater than forces produced by high-capacity cars. But the

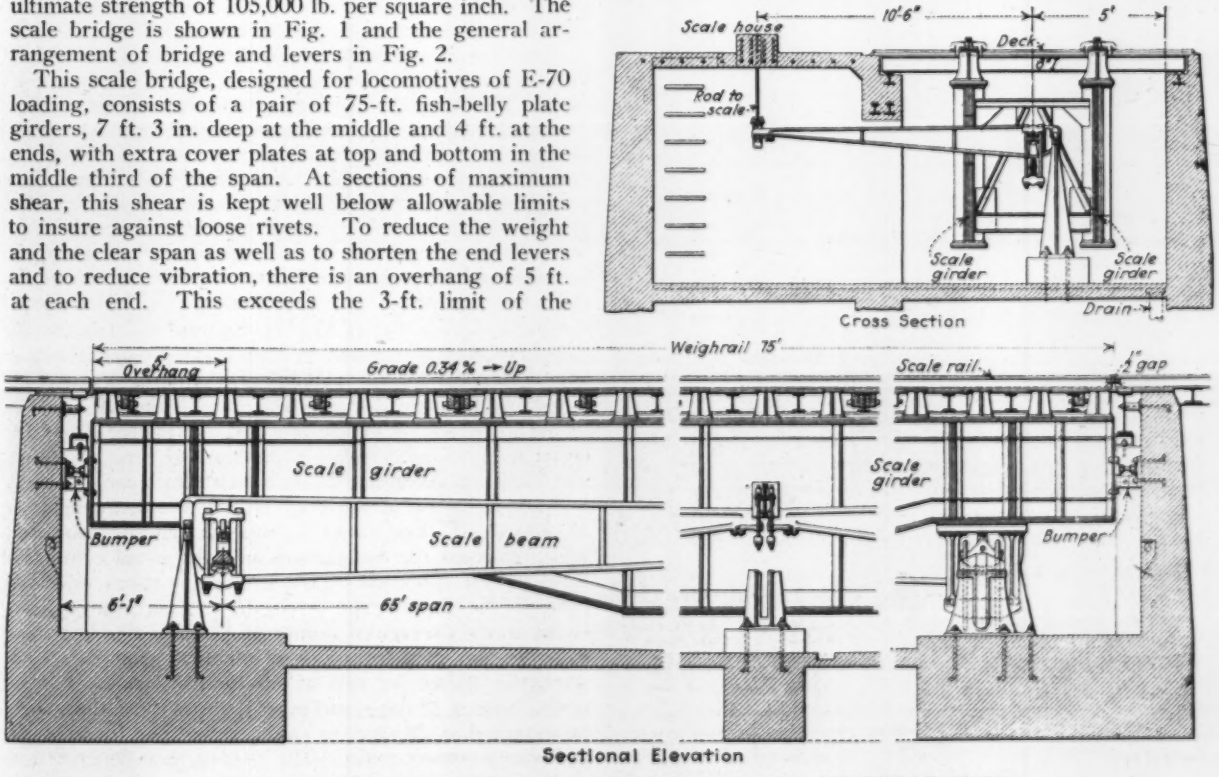


FIG. 2—TWO-SECTION TRACK SCALE, N. Y., N. H. & H. R.R., READVILLE, MASS.

effect of such cars is usually more severe than that of the locomotives used in yard service, while the allowable loading per linear inch of knife-edge is not exceeded ordinarily by engines used in classification yards. Furthermore, at many yards the dead-rail track is not used, but the scales appear to maintain their accuracy as well as those where the dead-rail track is used regularly.

In view of this apparent lack of necessity for the dead rail and in view of the simplicity of lever system and single-span bridge in the two-section scale, such a scale, of 150 tons sectional capaicty, was designed, having 50-ft. weigh rails and no dead rail. The first scale of this type was installed by the Wabash Railway at North Kansas City, Mo., handling engines of the E-55 loading and requiring less adjustment than a four-section scale under similar conditions. The new scale at Readville was designed and built by the Howe Scale Company, Rutland, Vt., under the direction of Edward Gagel, chief engineer, and R. L. Pearson, engineer of maintenance of way, New York, New Haven & Hartford Railroad. Its installation and tests were in charge of George H. Rodman, superintendent of bridges and buildings for the railroad, and M. H. Starr, chief engineer (now consulting engineer) for the builders.

Winter-Laid 10,000-Lb. Concrete on Chicago Viaduct

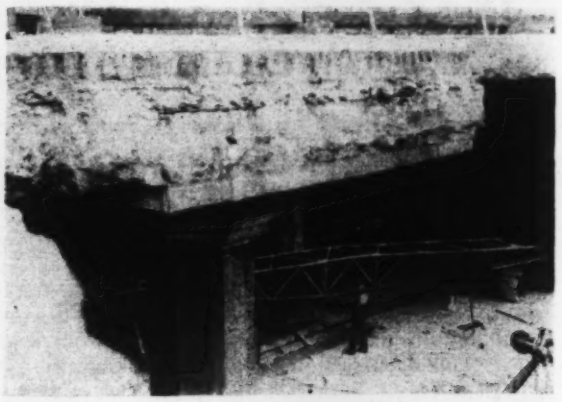
High Quality of Four-Year-Old Concrete Disclosed in Wrecking Portion of Wacker Drive for New Wabash Ave. Bridge

By Arthur R. Lord
Consulting Engineer, Chicago

THE city of Chicago is now building a new bascule bridge across the Chicago River at Wabash Ave. Since the south abutment of this new bridge occupies a portion of the broad plaza of Wacker Drive at this street, a large area of the reinforced-concrete deck slab of the drive and several supporting columns had to be removed. During the demolition work chunks of concrete were taken from the débris and tests were made of sawed cubes representing both slab concrete above and paving base concrete. The results of the tests, given in the accompanying tabulation, show an average strength for the 3x3-in. cubes of 11,400 lb. per sq.in. Cylinder tests at 28 days showed a strength of 2,620 lb. per sq.in.

The concrete in this portion of Wacker Drive was placed on Jan. 6 and 7, 1926, as a part of a placing operation that started on Jan. 4 and continued without interruption, day and night, for 99 hours. The weather, favorable at the beginning, relapsed into severe cold later, but at the time this particular portion of the Drive was placed had moderated somewhat and turned into a snowstorm. Temperature in the air above the slab varied

Sample From	Test No.	Crushing Strength, Lb. Per Sq.In. 3x3-In. Cubes	Crushing Strength, Lb. Per Sq.In. Equiv. Cylinder (85 Per Cent Cube Strength)
Superstructure	1	10,200	8,700
	2	11,800	10,100
	3	12,700	10,800
	4	11,200	9,500
	5	11,200	9,500
	Average	11,400	9,700
Paving base	6	10,200	8,700



TYPICAL CONCRETE, WACKER DRIVE VIADUCT, CHICAGO

from zero to slightly below freezing. All materials were heated, to give temperatures in the fresh concrete of about 80 deg. F. at the mixer, about 60 deg. F. at the forms and about 35 to 40 deg. F. at the upper surface of the slab by the time it had hardened sufficiently for workmen to cover it with straw. The air beneath the slab, heated by salamanders, varied from 55 to 85 deg. F. through the curing period of seven days. Under the hay, the surface of the slab showed comfortable temperatures for the entire week, well above the usual specification of 50 deg. F. minimum.

This concrete was made with the usual winter proportions—seven sacks of cement, 14 cu.ft. of Beloit sand (fineness modulus about 2.8) and 22 cu.ft. of crushed limestone (fineness modulus about 6.6). The water-cement ratio, allowing for the moisture in the aggregates, was about 6.5 gal. of water per sack of cement. The slump of the concrete at the forms showed an average of 2.9 in. for the two days, Jan. 5 and 6.

Eighteen sets of 6x12-in. test cylinders (from eight to sixteen cylinders to a set) were taken on these two days. The average crushing strength of 7-day cylinders was 2,120 lb. per sq.in., of 28-day cylinders 2,620 lb. per sq.in. The small increase between the 7-day and 28-day period was due to the fact that heating was discontinued beneath the slab after seven days. Test cylinders were stored on plank platforms located in the formwork so as to have a temperature equal to the average between the top and bottom temperatures of the slab, as nearly as we could arrange it. If Slater's equation, $S_{28} = S_7 + 30\sqrt{S_7}$, be used to estimate the probable 28-day strength of this concrete under favorable curing conditions, we obtain a value of about 3,500 lb. per sq.in., instead of the actual test value of 2,620 lb.

This concrete was 46 months old at the time the cubes were tested. Cubes were damp at time of testing and were capped on both ends with a thin layer of plaster of paris in the usual manner. In the accompanying table a column of "equivalent cylinder strengths" appears, which is given for comparison with the usual cylindrical form of test specimen. This strength is taken as 85 per cent of the actual cube strength, the percentage being based on the average of numerous published comparisons of cube and cylinder tests of identical concrete. The strengths shown by test at 46 months are over three times those at 28 days, and over 2½ times those that would be expected at 28 days in summer weather for this mix and water-cement ratio. The paving base concrete was about a 1:9 mix placed with no slump and hand tamped.

Engineering Aspects of the Present Drought

Municipal Supplies and Power Plants Not Yet Affected Generally—Serious Shortage Looked for Later in the Season Due to Depletion of Groundwater Supplies—Stream Pollution Increasing

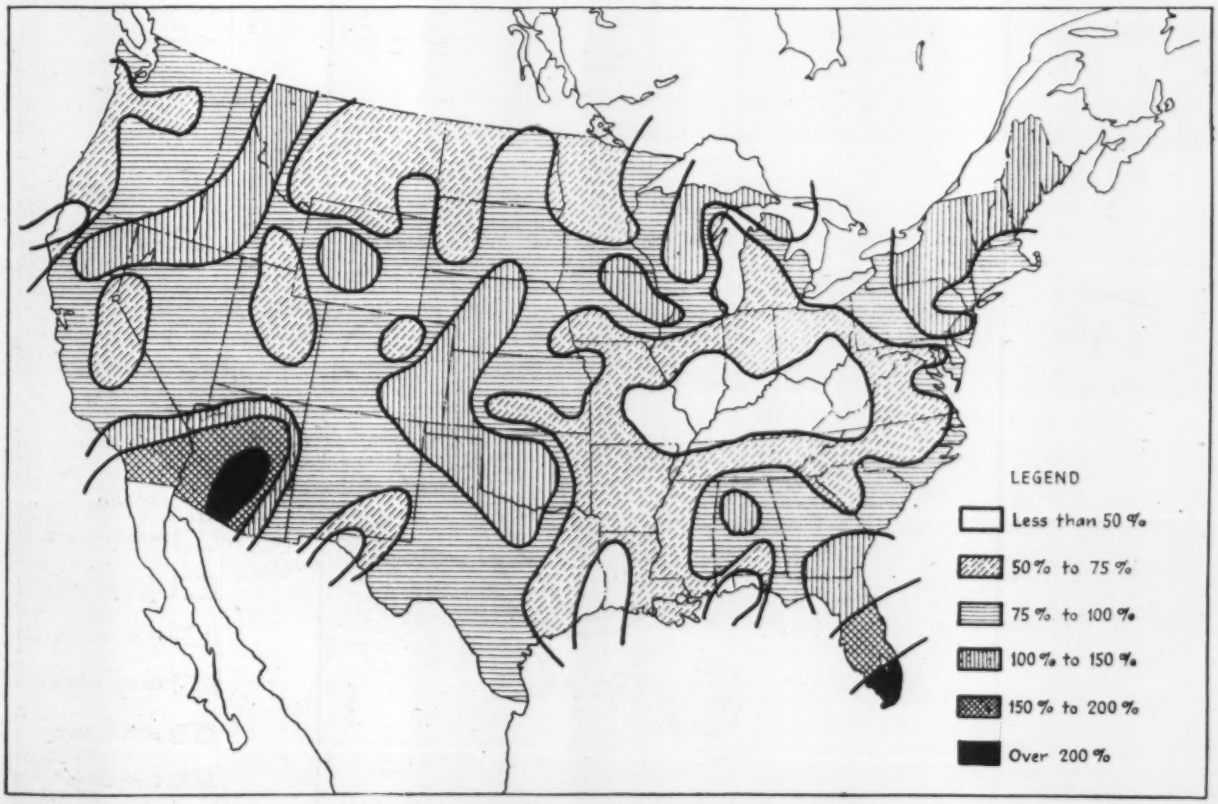
WIDESPREAD lack of rainfall has within the past two weeks become a matter of national concern. Just now attention is concentrated upon the effect of the drought upon agriculture and upon the problem of aiding the farmer threatened with loss of his crops and livestock. There are, however, other sides to the situation which later will become matters of public concern in any extended drought such as appears now to be upon the country. Failing water supplies, increasing stream pollution and curtailment of power resources, all come in the latter stages of a long drought. As they are already beginning to cause concern among engineers, an attempt has been made to give in what follows a summary of facts and of opinions of the men in federal bureaus in Washington who are charged with the responsibility of collecting and correlating rainfall, runoff and weather statistics. Few of these experts care to make any predictions as to what may be expected. They point out, however, that this is only August and that normally the period of low water is not due until September or even as late as November. Long-time records show that streamflow may be expected to fall off until the autumn period of low water. No ordinary rain can do more than check this downward trend. Inasmuch as many streams have already reached their recorded low flow it is almost certain that further recessions will bring about a lack of water such as has never been known in this country. Even if rainfall should return to normal many streams will continue to fall due to a depletion of groundwater supply.

General Drought Situation—Few statistics are needed to convince anyone within the wide areas affected that this is the greatest drought so far in American history. Starting as early as last November in some regions and in February in others, the drought has grown to cover most of the United States east of the Rocky Mountains with the exception of the extreme southwestern states and parts of New England where rainfall is normal or above. The Pacific Northwest also has been dry; otherwise the West Coast is normal and rainfall in the southern Rockies has been unusually high.

Weather Bureau charts tell the whole rainfall situation at a glance. The worst deficiency has been over a great curved belt extending up the Mississipi-Ohio system from the Gulf and on across to the Atlantic seaboard.

Comparing conditions with years past, the accompanying tables for the principal agricultural states show in how many instances minimum rainfall records have been set in the unparalleled dryness of June and July.

Temperature reports indicate that almost the whole United States has felt the July heat. Hardly any points are at normal or below. Excesses of 5 or 6 degrees above normal do not look spectacular but it must be remembered that these figures represent an entire month.



PRECIPITATION RECORD, MARCH 1 TO JULY 22, 1930

The figures given are percentages of normal precipitation as prepared by the Weather Bureau in its preliminary study of the drought situation.

How the Weather Has Acted—The proximate cause for these weather anomalies may be described as a stagnation of the atmosphere, a widespread ceasing of normal circulation. As always, the air over the continent is passing steadily from west to east but much too steadily. In order for rain to fall this great horizontal blanket of moving air must be disturbed by vertical currents which carry the lower moist air into the cold upper atmosphere where the moisture is precipitated.

Low-pressure formations, through which such upward currents develop, have been lacking. A few weak lows have passed too far to the north to do much good. Otherwise the weather maps for the past several weeks have shown mainly a procession of highs following each other across the country. A little rain has occurred in the high-pressure areas, as can happen. Local thunderstorms have materialized from convection currents over the heated countryside. But no big general rains have come over.

It is a normal summer condition for lows to pass farther north than in winter and for high pressures to predominate across the United States but not to such a marked extent. When will this stagnation break? Though a sudden change is possible at any time, the drought is so firmly intrenched that recovery may be slow. As might be expected with the land surface so dry, humidity is low. Thus moisture for heavy rains is somewhat lacking in the air. Obviously these factors may retard recovery though it is a risky business to predict further ahead than the day after tomorrow.

Water Supply and Sanitation—So far, few cities have felt any great lack of water although some towns and suburban districts have had to discontinue sprinkling lawns and gardens. In some cities fire engines have been attached to pipe lines to build up pressure. In others, temporary diversion dams have been put in to raise stream levels to the intakes.

The sanitary situation has not yet resulted in any large epidemics. With the rivers so low sewage pollution has, however, been much more noticeable than in normal

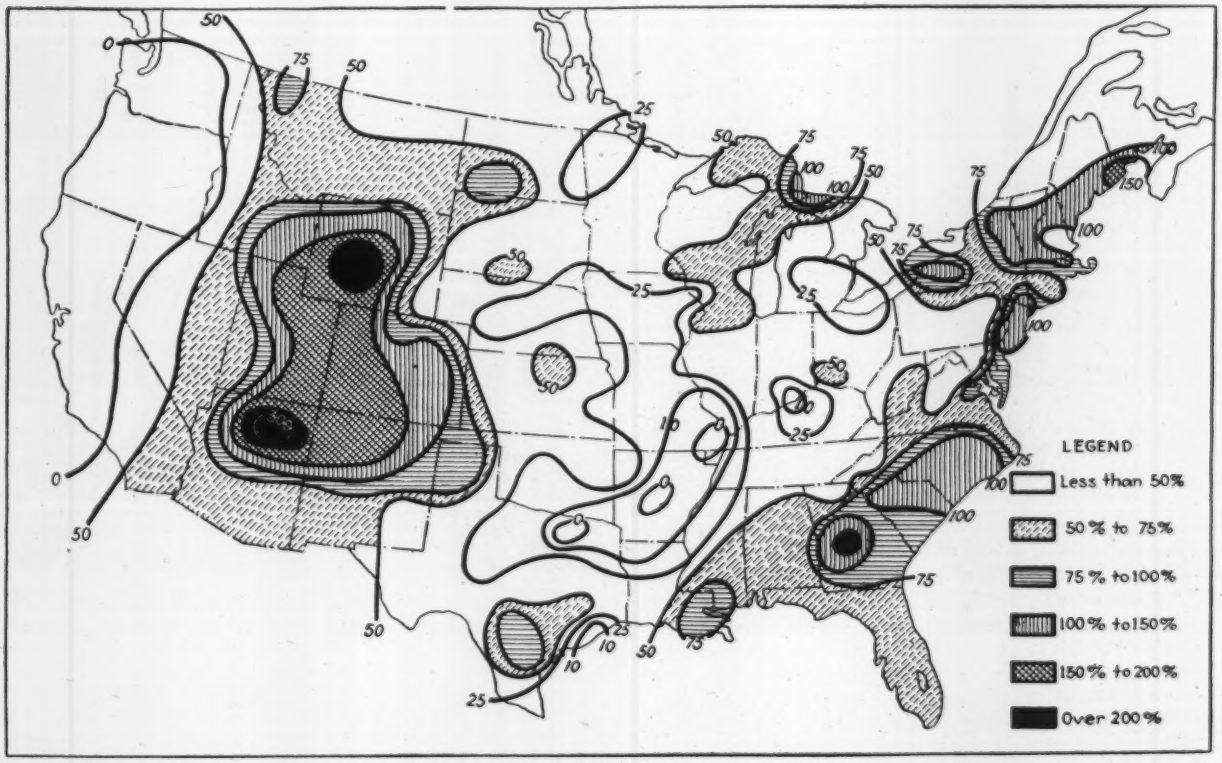
TOTAL RAINFALL IN JULY, 1930, FOR PRINCIPAL AGRICULTURAL STATES

Maps and tables are from preliminary compilations by J. B. Kincer, Chief, Division of Agricultural Meteorology, U. S. Weather Bureau.

State	July Rainfall, In. 1930	Previous Record	Date Previous Record	Years Wherein July Rainfall Was Lower Than in 1930
Ohio	1.4	1.6	1894	Record
Kentucky	1.4	1.7	1901	Record
Indiana	1.8	1.3	1901	1901, 1911, 1894
Illinois	1.0	1.2	1916	Record
Missouri	0.9	1.2	1916	Record
Tennessee	0.9	2.0	1902	Record
Oklahoma	0.6	0.8	1916	Record
Arkansas	0.65	1.5	1918	Record
Texas	0.6	0.9	1924	Record
Iowa	1.2	0.6	1894	1894, 1886
Kansas	1.6	0.8	1916	1916, 1917
Nebraska	1.4	1.2	1894	1894, 1877
South Dakota	0.8	0.9	1894	Record
North Dakota	1.0	0.6	1894	1894
Maryland	1.4	1.6	1909	Record
Virginia	2.0	3.0	1925	Record
West Virginia	1.9	2.2	1894	Record

TOTAL RAINFALL IN JUNE AND JULY, 1930, FOR PRINCIPAL AGRICULTURAL STATES

State	June and July Rainfall in 1930	Previous Record	Date Previous Record	Years Wherein June and July Rainfall Was Lower Than in 1930
Ohio	3.7	4.2	1894	Record
Kentucky	3.2	4.7	1894	Record
Indiana	4.4	4.0	1894	1894, 1914
Illinois	4.4	3.8	1901	1901
Missouri	3.7	4.1	1901	Record
Tennessee	2.3	5.1	1914	Record
Oklahoma	4.3	2.6	1914	1914, 1901, 1894
Mississippi	2.8	5.2	1901, 1924	Record
Louisiana	3.5	4.5	1924	Record
Arkansas	1.5	3.5	1896	Record
Texas	2.7	3.0	1914, 1924	Record



PRECIPITATION RECORD OF THE UNITED STATES FOR JULY, 1930
Percentages of the normal precipitation are given as in the upper figure.

flow. Some commercial establishments have been ordered to stop dumping wastes or refuse into rivers.

Hydro-Electric Power Affected—While difficult to show in figures, there can be no question that water-power output is below normal. Under the circumstances, it simply could not be unaffected. Some rough idea can be given by the following analysis. In April, May, and June last year, 42 per cent of the nation's power was produced by water while the proportion fell to 40 per cent for the same months of 1930, according to geological survey reports. There is reason to believe that the normal ration might have been as high as 45 or even 50 per cent with heavy streamflow. The factors involved are, of course, highly complex and no official estimates have been made to iron out the effect of the business-cycle swing in a compensated power curve.

Next year's floodflows will be affected by the drought to a degree which will depend largely on how much rain comes during the fall and winter. In all probability no unusually high stages can be expected next spring on the river systems in the drought area due to groundwater depletion. Navigation is suffering some on the Mississippi, with stages at a record low for this time of year.

Summary of Drought Conditions

Arkansas—Streams are now at lowest point during period of continuous record 1922-30. Prior records scanty. Conditions indicate further recession.

Alabama and Mississippi—Rainfall for first six months this year produced a minimum record for Alabama. Comparisons on streamflow are difficult as power regulation is keeping up flow. Ordinarily low water comes from August to November. It is possible that some streams may reach a record low by fall. So far general conditions are not as severe as 1925 in most parts of the region. The Alabama Power Co. estimates its Martin reservoir 2 ft. below normal but 2 to 5 ft. higher than it would have been if operating in 1925, 1914 or 1904. Small reservoirs are about normal.

Georgia and Florida—Florida rainfall is above normal. In Georgia conditions are not so bad as in 1925. Burton reservoir is 2 ft. below computed normal but 2 ft. above 1927, 43 ft. above 1925 and 3 ft. above 1904.

Tennessee—Rainfall has been deficient since January; three-quarters normal to June and one quarter to one half normal since. Groundwater is badly depleted. Streams are still 25 to 50 per cent above same period of 1925. Do not expect that extreme lows of 1925 will be reached.

North Carolina—Streams still above 1925 drought except along Virginia border in north, where they are lower. From November to June the rainfall deficiency has been 12 per cent below normal. Streamflow is 10 to 20 per cent below normal, with conditions better in the eastern part of the state except for the Roanoke River.

Virginia—Streams mostly not so bad as in 1925, which was worst in 30-year record. Streams 20 to 25 per cent higher than then. Rains last fall provided a good groundwater supply which is now being drawn upon. Spring-fed streams are in much better shape than others, some showing surprising runoff for drainage area involved. Municipal water supply situation not serious yet, though some companies have cautioned consumers against waste and some have made temporary shutoffs. Some fruit growers are hauling water from rivers to save part of crop.

West Virginia—Absence of June rainfall caused July lows in runoff. Smaller streams totally dry and larger streams are reduced to trickles. Rivers vary from one-tenth to two-thirds normal. Groundwater is low, as shown by unprecedented well failures. Lawn and garden sprinkling banned at points. Garbage dumping from some vegetable markets prohibited to safeguard water supply. Glenville has installed a temporary dam to bring water to intakes.

Ohio—Low occurs in September. Most of larger streams are at about twice the 1925 minimum, though some smaller ones already have reached it. Upper Ohio River kept at good flow by regulation.

Indiana, Illinois, Kentucky—Rainfall below normal since February, the most serious deficiency being in southern Illinois and Indiana and northwestern Kentucky. Since July 1 little rain has fallen and temperatures have been high. Streams in northern Illinois are not expectionally low, but in central and southern parts of the state they are lowest encountered up to July in any year since 1914 and are expected to go much lower before fall. This will not be serious, as there is comparatively little hydropower in Illinois and few cities depend on streamflow for water supply.

Missouri—In northern part of state rainfall is not much below normal and streams are considerably above lows reached during past few years. Southern part very dry with streams 20 to 40 per cent higher than minimum reached September, 1925. Normal low comes in September or October. Missouri River 30 per cent over minimum of October, 1929. Mississippi River at St. Louis approaching minimum stage for this time of year, but channel improvement upsets comparison with old records. Groundwater supply is good, as 1929 was a wet year. The year preceding the 1925 drought was dry. This would indicate better runoff conditions through 1930.

Texas—Most streams substantially above record minima, though some smaller streams are close to lowest flows hitherto recorded.

Minnesota—Drought is not serious. Frequent local showers in May, June and early July have kept most streams near normal, though the latter part of July was very hot and dry. Accumulated effect of 1929 drought is more apparent on lake levels than on rivers. One lake shows gradual decrease since 1927. Discharge of Mississippi River at St. Paul is regulated by several reservoirs at head of river. Stored water in all reservoirs below normal. Mississippi flow is lowest in twenty-year record except 2,600 sec.-ft. in 1926.

Wisconsin—No serious drought. Rains have been sufficient, though not abundant except for latter part of July.

Pennsylvania, Maryland and Delaware—Gettysburg, Hanover and Lebanon, Pa., are reported to be facing water shortage. Streams and wells are going dry in this region; conditions compared with 1895. York Haven and Conowingo power plants on Susquehanna River are at lowest stage of their operating period. The Delaware River July minimum is comparable to July, 1926, but lower stages are expected later in season. The Potomac River is down to 1,100 sec.-ft.; minimum record is given as 800 sec.-ft., but this figure is thought too high because of possible power regulation. Tributaries of Potomac, except spring-fed streams approaching record, with minimum for all time expected later. District of Columbia water supply not menaced, though some of the suburbs are finding their separate systems inadequate and are tapping auxiliary sources. One Maryland village reports no electric lights because of no water to operate local plant.

New Jersey—Season started with conditions pointing to extreme drought, since precipitation for March, April and May was considerably below normal. However, rain for June and July picked up to ½ in. above normal.

New York—No shortage of water reported by power plants on Hudson River, which is well regulated. Upper Susquehanna drainage was below normal in April and May but about normal for June and July. Probably most of state in fair condition.

Connecticut—No serious drought. Rainfall was deficient from November, 1929, until the spring, but in May, June and July it was above normal—in fact, too much for the crops at times. Runoff conditions much better than last summer, when record low runoff occurred. Heavy precipitation and spring freshets in 1929 were followed by long dry period with virtually no spring floods this year. The recent 2½ months of excess rain provide ample flow for power and municipal purposes.

Massachusetts, Vermont and New Hampshire—Conditions are good in northern Vermont and New Hampshire due to winter snows and subsequent rains at or above normal. In Massachusetts and southern New Hampshire, however, drought conditions are severe. State boards of health are having trouble to prevent contamination of streams. Wachusett reservoir supplying metropolitan Boston is at a record low. Lowell, Mass., rainfall is at lowest point since 1836 in 104 years of record; Sudbury record is lowest in 55 years. Frequent and well-distributed thunderstorms have helped some streams, but if no general rains come by Aug. 31, record minima are expected in runoff.

Maine—No drought; runoff normal or above.

Groundwater Conditions—Little definite information is available regarding the depletion of water in underground storage except that given by the failure of wells and springs and the falling off of streamflow. In general, government experts believe that the season started with ample groundwater supply, which has saved the situation so far. In North Carolina some engineers think that their groundwater supply has not recovered from the drought of 1925. Elsewhere there is little evidence that such a condition can be very general.

Observations show that the trend of groundwater levels in the United States is generally downward through the summer, regardless of rain. Until fall, only a very heavy rain can check the gradual lowering of the groundwater table in most places. This year groundwater has been the saving factor in water supply so far. Slight rains over the parched ground have been soaked in with light runoff. Next year, unless fall and winter precipitation is heavy, some areas may suffer due to deficient groundwater.

Immediate Streamflow Data Lacking—Beyond these general comments, up-to-the-minute data on streamflow conditions are hard to get. Ordinarily there is no national need for immediate returns, so federal streamflow investigations are on an annual report basis. Local interests are posted as to their own operating requirements but there is no way of assembling their information quickly over any large territory.

In order to give some idea of what is happening, the water-resources branch of the U. S. Geological Survey has obtained reports from all its district offices east of the Rockies as of early in August. This summary is based mainly on information collected under the direction of N. C. Grover, chief hydraulic engineer for the survey. A similar study has been undertaken by M. W. Hayes, in charge of the Weather Bureau's river and flood division, but the returns have just started to come in and no extensive report will be available for some weeks.

The Summer School for Engineering Teachers

Civil Engineering Session at Yale Under Auspices of S.P.E.E. Attended by Teachers From 30 States—Leading Educationalists and Practicing Engineers on Faculty

By Frederic N. Weaver
Assistant Professor of Civil Engineering, Tufts College, Medford, Mass.

THE COMPLETION recently at Yale University of the civil engineering session of the summer school for engineering teachers calls attention to this unique undertaking in higher education. Having its inception in the study of engineering education in the United States and Europe as conducted by the Society for the Promotion of Engineering Education from 1924 to 1929 inclusive, the summer school is an effort to carry into practical effect some of the recommendations of that study toward improvement in the quality of teaching.

In the civil engineering session 88 teachers representing 30 states and two foreign countries gathered to study intensively both the content and method of teaching civil engineering subjects and lived together for a period of three weeks in the dormitories of the Sheffield Scientific School.

The avowed aim of the school is "to teach teachers to teach." An equally important aim is to enrich and broaden the experiences of teachers of engineering through intimate contacts with one another and with distinguished members of the profession acting as the staff of the school. Consequently, the work of the session was by no means confined to the lecture and classroom. Three days were spent by the entire party at the Yale engineering camp at East Lyme, Conn., where, in addition to the formal parts of the program, the teachers renewed their acquaintance with the life of the surveying camp. This experience served the definitely planned purpose of having the entire group become acquainted with one another and with the members of the staff. Later, on the campus at New Haven, at the end of the day's session and until far into the evening, groups of teachers would be found "talking shop," discussing their problems, and consciously or unconsciously widening their acquaintance with the entire field of engineering education. Numerous trips to local points of engineering interest furthered the same end.

Many of the teachers attended the session at considerable sacrifice of time and money as is witnessed by the fact that representatives came from the Pacific Coast, western Canada, the Rocky Mountain states and from the far South, as well as from the Middle Western states and from the East. The group was a representative cross-section, not only of states and institutions, but also of the various teaching ranks.

In order to meet the needs of such a varied group the program was divided into two major parts: one attended by all the teachers present, and the other arranged in three divisions for teachers of structural engineering, sanitary and hydraulic engineering, and railway and highway engineering respectively. The general division of the program was devoted to such topics as the history of civil engineering, educational principles and practices, professional aims, business relations of civil engineers, engineering materials and economics of engineering.

The divisional meetings or classes were devoted to the intensive study and discussion of the more direct aspects of teaching the subjects mentioned. The structural engineers, for example, began their work with the study of methods of teaching mechanics of materials. They then attacked the methods of teaching framed structures, structural design, foundations, reinforced concrete and the methods of analyzing such individual structures as movable bridges, arches and suspension bridges.

The sanitary and hydraulic division began with the teaching of hydraulics and studied in turn the teaching of public water-supply engineering, sewerage, sewage treatment, sanitary biology and water-power engineering. Similarly, the highway and railway division started with the outlines of courses and proceeded to a discussion of economics, administration and finance, and special problems in transportation.

As at previous schools, the staff of the session on civil engineering was notable for the number and quality of its members. Included among the teachers were: Anson Marston, dean, Iowa State College; F. E. Turneaure, dean, University of Wisconsin; C. C. Williams, dean, State University of Iowa; Richard D. Tyler, dean, University of Washington; Charles M. Spofford of the Massachusetts Institute of Technology; James K. Finch of Columbia University; Herbert F. Moore of the University of Illinois; Almon H. Fuller of Iowa State College; William K. Hatt of Purdue University; Francis P. Witmer of the University of Pennsylvania; Sherman M. Woodward of the State University of Iowa; Thomas R. Agg of Iowa State College; Elton D. Walker of Pennsylvania State College; Charles M. Allen of Worcester Polytechnic Institute; and Gordon M. Fair and Francis T. Spaulding of Harvard University.

Among the practicing engineers who lectured on technical aspects of civil engineering work were: John F. Coleman, president, American Society of Civil Engineers; Alfred D. Flinn, director, Engineering Foundation; F. R. McMillan, director of research, Portland Cement Association; Charles S. Whitney, J. A. L. Waddell, O. E. Hovey, Clarence W. Hudson, Frank P. McKibben, Leon S. Moisseiff, William P. Creager, T. Chalkley Hatton, Robert S. Weston, Samuel Eckels, and George P. Ford.

Since its inception in 1927 with sessions of engineering mechanics at Cornell and at the University of Wisconsin, the S.P.E.E. summer school for engineering teachers has enrolled nearly 500 members. It has in addition included over 200 staff members. With hardly a single exception no institute of recognized standing has failed to be represented. Sessions have been held on engineering mechanics, physics, electrical engineering, mechanical engineering, engineering drawing and descriptive geometry, and civil engineering.

The session at Yale was sponsored and supported by Yale University, the American Society of Civil Engineers, the Highway Education Board and the Portland Cement Association. It was under the immediate direction of John C. Tracy, professor of civil engineering at Yale University, who served as the local director, and of Prof. Roscoe H. Suttie of the civil engineering department of Yale University, secretary of the conference.

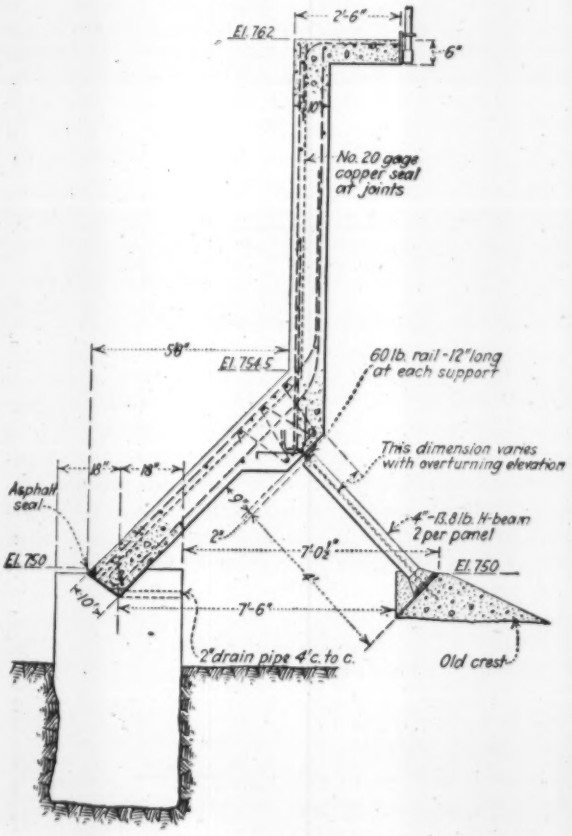
The various summer schools are under the general direction of H. P. Hammond, professor of civil engineering, the Polytechnic Institute of Brooklyn.

From Job and Office

Hints That Cut Cost and Time for the Contractor and Engineer

Tilting Slab Flashboards Provide Emergency Spillway

CONCRETE flashboards which will automatically be released in the event of unusual high water are a feature of the improvements completed for the spillway of the Dix River dam plant of the Kentucky Utilities Co., near Burgin, Ky. In order to utilize more storage, the 750-ft. spillway has been raised 10 ft., bringing the new pond level to El. 760. For a part of the spillway length this raising has been accomplished by the installation of ten steel gates, each 35 ft. long, which are capable of maintaining the pond level at El. 760 at all times



TILTING SECTION OPERATES AS EMERGENCY SPILLWAY

except those of extremely high flow. A study of the stream's history leads to the conclusion that in only one year in every hundred would the stream's flow be sufficiently great to overtax the capacity of the new gates.

In order to provide for such an eventuality, however, the flashboards used to raise the remaining length of the spillway have been so designed that they will be tipped over should the pond level ever reach an elevation slightly more than 760. These flashboards are made up in sections 12 ft. long. Their outline is shown in the accompanying illustration. In overturning, the sections pivot momentarily about the point of bearing between the steel rail embedded in the concrete and the H-beam strut. Replacement will be necessary after such operation, as it is not expected that the sections will be recovered.

The various sections are so designed that they will go out progressively as the water level rises through a narrow range above El. 760. This variation is accomplished by having the steel rail bearing located at varying positions on the heel of the sections.

The design of the new spillway, including the tilting portion, was prepared for the Kentucky Utilities Co. in the office of L. F. Harza, consulting hydro-electric engineer, Chicago, Ill.

Digging Wide Trenches and Basements With Ditching Machine

SEVERAL interesting experiences at the University of Oklahoma, utilizing a 21-in. vertical-boom ditcher for miscellaneous excavation, are given in a letter from Walter W. Kraft, superintendent of the department of university utilities, to the Barber-Greene Co. According to Mr. Kraft, the ditching machine has been used several times for digging wide trenches, the first experience during the installation of a utilities tunnel $6\frac{1}{2}$x$4\frac{1}{2}$ ft. inside measurement. On this 700-ft. job the machine removed two cuts, one at each side of the trench, the core remaining between the cuts being removed by hand. The machine-cut outside edges of the excavation were used as outside forms for the tunnel. On a similar job undertaken later, comprising about 1,500 ft. of additional tunnel, three cuts were made, the last of which removed the core.

The ditcher was also used in the construction of two buildings without basements. Footings had to be installed around the edges of the building at a depth of about 4 ft. below grade. They were placed in trenches 30 in. wide, taken out in two cuts. Excavated material was placed inside of the building. A warehouse building

CUTTING THIRD COURSE FOR WIDE TRENCH EXCAVATION

calling for a basement excavation about 5 ft. deep was also erected. All excavation for this job was done with the machine, the material being loaded into trucks without any hand labor. In order to cut the basement to an exact level, the ground was leveled off so that each cut would be at the same depth. The machine passed back and forth across the area, the crawler wheels on one side being supported by a series of benches moved after each cut. The entire area, involving the excavation of more than 500 cu.yd., was completed in less than twenty hours.

Five Concrete Stacks Demolished by Burning and Blasting

By Wallace B. Hartshorn
Fort Worth, Tex.

UNUSUAL methods were employed recently in Fort Worth in demolishing five concrete stacks, four of them 100 ft. high and one 150 ft. high. The stacks were all similar in construction, built of 14-in. concrete walls reinforced with ¾-in. square twisted rods about 6 in. on centers and lined with firebrick.

The four shorter stacks were demolished in the following manner: A cord of wood was burned around the base on the outside of the stack, spalling and damaging the concrete so it was easily chipped loose from the reinforcing by sledgehammers. Then the exposed reinforcing bars were burned through with a torch. Following this the firebrick lining near the base of the stack was broken loose by using fifteen sticks of 60 per cent dynamite. When the bricks had been cleared out, twelve

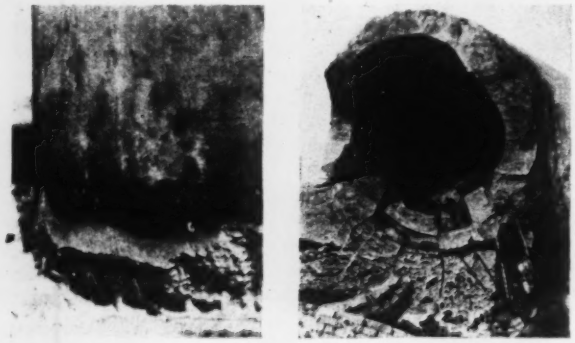


FIG. 1—BASE OF CONCRETE STACK BEFORE AND AFTER FALLING
Left: Reinforcing rods exposed after burning and chipping concrete.

sticks of dynamite were placed inside on the fall side, packed with dirt and cord wood and exploded. The stacks fell in one piece but the impact of the fall broke them at every 8-ft. construction joint. All but the lower 35 ft. pulverized, revealing that the reinforcing above this point had been reduced to 18-in. spacing. Set with cement mortar, the firebrick lining remained intact in the sections that did not crumble, though it had been expected that this lining would peel out.

An attempt was made to bring down the tall stack by the same method, but after burning and chipping out around the base it was found that the reinforcing was located near the inside of the wall instead of the outside. After the concrete was chipped loose from the inside far enough to expose the rods, the wall was too thin for

FIG. 2—VIEW OF ONE OF STACKS AFTER FALLING

dynamiting and another method of dropping the stack was employed. An 8x10-in. timber was placed as a trigger support in the door of this stack, and after further weakening the wall, burning the trigger out was contemplated, letting the stack fall of its own weight. But when the trigger had burned out the stack tilted to an angle of approximately 10 deg. with the vertical, with the top projecting beyond the base ring, and stopped in this position. Investigation showed that the fall side had settled down upon the base and the stack was prevented from falling by fifteen ¾-in. rods on the tension side. After four of these rods had been cut the stack commenced to move, breaking six of the remaining rods and stripping five out of the concrete.

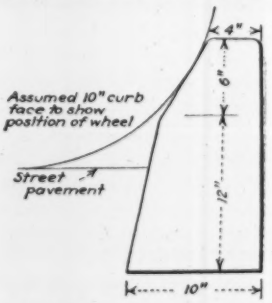
Wrecking several small brick buildings adjacent to the stack was facilitated by permitting three of the smaller stacks to fall upon them. The total cost of wrecking the five stacks consisted of five cords of wood, 100 sticks of 60 per cent dynamite and 102 man-hours of labor, of which 11 man-hours was burning time. Wrecking the stacks was done by J. E. Burgess, of Fort Worth.

Improved Curb Design Increases Safety

By Edward H. Tatum
Los Angeles, Calif.

CURB designs have not kept pace with changing traffic conditions. With the advent of larger tires on cars, the curb now becomes a frequent source of expense to automobile owners when bumped into accidentally or rubbed against when parking. Hubs and running-boards also come in for their share of the damage when parking alongside of a curb having a height of 10 in. or more.

This new design is intended for use under all conditions from a 0-in. curb face on returns up to the full 18-in. height when necessary for surface drainage. It has a vertical back and two batters on the face; the lower batter 2.67 in. to 12 in. and the upper 3.33 in. to 6 in. The junction line should be rounded off when the curb face is troweled smooth. Front and back top edges are ¾-in. radius. Slightly less than 1 cu.ft. of concrete is used per linear foot of curb.



SECTION OF CURB WITH TWO BATTERS

The lower batter is designed to give clearance for running-boards, hubs and wire wheels when parking parallel to the street. The upper batter eliminates a large amount of breakage in loading and unloading by providing a wide face to take the direct thrust of the wheel when backing against the curb. This eliminates the necessity for curb armor in

commercial and industrial districts. The upper batter also has other advantages: (1) On curb returns, with faces varying from 0 to 8 in., the rims of solid-rubber tired trucks cannot come in contact with the curb, nor will the walls of pneumatic tires be injured; (2) When parked against the curb and cramped front and back, the top batter allows the wheel to turn to a greater angle, making it possible to get away more easily.

Letters to the Editor

Only Inferior Contractors Shop for Bids

Sir—The editorial note in *Engineering News-Record*, June 19, 1930, p. 999, headed "More Bad Competition" deserves attention. The writer has been bidding under general contractors since 1891 and most of that time in lines related either to buildings designed by architects or for sanitary plants designed by engineers.

What you say of the practice of some general contractors, and especially their purchasing agents, regarding shopping of bids is true. However, in the writer's general average of experience, covering nearly 40 years in New York, while there are some shortsighted contractors who shop sub-bids (many purchasing agents consider it their privilege and duty to do so), the better and more responsible contractors know perfectly well that if they invite a manufacturer to submit a bid to them for their part of the work in advance it is unfair to shop these advance bids and abuse confidence. The general contractor makes his bid and signs on the dotted line after he has secured enough sub-bids, together with the work that he does himself, to enable him to make a bid and to execute a contract.

The shortsighted contractor who abuses subcontractors belongs to a very small class. He is well known to the average manufacturer, and frequently does not receive as favorable prices as the more responsible and better contractors, who treat their sub-bidders honestly.

Summarizing, your statements are correct, but shopping for bids is not common except by the lower class of contractors, of which there are a few, as it is not a paying proposition to any contractor to abuse subcontractors.

New York, N. Y., June 27, 1930. S. Fischer Miller, President, Pacific Flush Tank Co.

Federal Power Commission Defended

Sir—I have just noted some editorial comment on p. 43 of your July 10 issue in which there appears the following statement:

> The original Federal Power Commission fell into disrepute because it was so constituted that the authority nominally vested in the three cabinet officers who made up the commission was largely exercised by their subordinates, to the dissatisfaction of the general public. Due to the growth of this dissatisfaction, Congress recently authorized the setting up of a new, full-time commission to take over the administration of the federal power act.

It seems probable that the above remarks were offered under some misapprehension. The Federal Power Commission has not "fallen into disrepute" with anyone except those who may have endeavored unsuccessfully to use it for the advancement of personal ends, and there exists no "dissatisfaction of the general public" with the conduct of the commission's affairs. It is true that during the past several months the commission has been made the target for violent factional criticism and partisan political attacks which have been entirely without merit or truth. This program has been fostered by some of the propaganda newspapers, and it is rather surprising to find your usually reliable journal misled by such irresponsible activity.

It is well recognized by those familiar with the situation that the commission's affairs have been conducted with efficiency and scrupulous regard for public interests. As reported in the July 12 issue of your affiliated publication, *Electrical World*, the results of the past year's work have been particularly gratifying in that the docket has been practically cleared of pressing applications and the accumulation from past years substantially reduced. The recent authorizations have included the disposition of a number of highly controversial cases which are inevitably accompanied by public clamor and misrepresentation. In rendering decisions in these cases, which will lead to constructive improvement of the industrial conditions in the localities concerned, the commission is justly entitled to commendation instead of carping criticism.

The reorganization of the commission, authorized by recent legislation, is the direct result of recommendations made last fall by the President that full-time commissioners be substituted for the cabinet-officer members in order that the latter might give undivided attention to the heavy responsibilities of managing their respective departments. There has been no evidence whatever that the commission's work has suffered under the former arrangement. On the contrary, it will be found that in the regions primarily concerned there has been no complaint regarding any phase of the commission's operations. What criticism there is comes from the localities destitute of water-power resources and ignorant of the public advantages in their utilization.

In justice to the many engineers on the staff of the commission and in the field organizations of the departments of war, interior and agriculture, who have conscientiously labored to bring about the present satisfactory condition of the commission's work, it would seem that the misleading impression conveyed by the editorial comment mentioned above should be corrected.

Washington, D. C., July 18, 1930. F. E. Bonner, Executive Secretary.

In reply to a statement on our part that our criticism was not directed at the present administration of the commission nor the result of the recent attacks upon it, but rather was the outgrowth of observations over a long period of time, Mr. Bonner made the statement given below.—Editor.

Sir—You may probably be correct about there being some features of the commission's activity in past years subject to criticism. I have been connected with the headquarters here for only the past year and, therefore will have to leave it to someone better posted than myself to defend the practices of the preceding period. I submit, however, that during the past twelve months substantial progress has been made toward placing all affairs of the commission on a sound businesslike basis in spite of obstructive influences. Moreover, I think the matters to which your criticism has been directed relate to minor features of the work, and a sweeping conclusion is hardly justified.

Doubtless, here in the East where little or nothing is known of the commission's work and public sentiment influenced largely by the partisan press and political quacks, you may be able to find some dissatisfaction, but I would regard this of little importance. The commission's job will have been well done if it may enjoy the support of the localities directly served.

Washington, D. C., July 26, 1930. F. E. Bonner, Executive Secretary.

Pavement Smoothness

Sir—The editorial in your July 17 issue entitled "Considerations on Pavement Smoothness" is of considerable interest to the writer, in view of the fact that the inauguration of the system of records and credits was made under his direction beginning about 1926. I felt at that time that to build up a competitive sipirit among the engineers in charge of various types of construction would lead to better work and promote an interest in improving construction which would be of general benefit to the state. As a result of this system we have steadily increased the excellence of our pavements, while, strange to say, there has been a corresponding decrease in cost due to the ingenuity exercised by various resident engineers in securing better ways of doing the work.

There is another phase to improved smoothness which is not brought out by the tabulations, and that is the great

economic value which undoubtedly was brought about by the increased speed which may be maintained over smoother highways. It is my opinion that, because of increased smoothness alone, there has been an increase in comfortable speed of not less than 5 miles per hour for all vehicles operating over our new highways. Not only does this mean a reduction in cost of operation per machine, but, in a state having such a registration as California, it means an enormous extension of the mileage which can be covered by any given number of machines, or, to use an equivalent comparison, it would mean that the number of machines required to cover a certain mileage could be reduced by a very great extent and the investment required in machines could be saved to the public. Some very interesting speculations have been made on this subject.

Your editorial seems to question the lasting quality of the smoothness which we obtain. Our investigations have been carried on for the last four years, and we find an increase in roughness on all types of pavement, but sufficient time has not elapsed to record properly the effect such increase has upon traffic. It is my belief that this increase in roughness will be greater during the first few years of life of the pavement than at a later period when it becomes more stabilized, especially so far as portland cement concrete pavements are concerned. With regard to pavements of the asphaltic type, it is quite likely that the roughness will gradually increase, but even at that, the pavements can become much rougher before they will be as rough as those laid under the old methods.

We believe the methods inaugurated under this department of reporting the performance of our various engineers, contractors and types of equipment are an inspiration to all concerned and will continue to result in better workmanship for some time to come.

In closing I would say that, while the system was inaugurated by the author and the reports to be made were outlined by him, the perfection of work attained in the field is largely due to the excellent supervision and training given to the resident engineers by the assistant construction engineers in charge of this work, and also by the spirit of co-operation shown by the resident engineers and contractors alike. Such co-operation and understandings are of benefit to the entire road-building industry.

C. S. Pope,
Chief Construction Engineer,
California Division of Highways.

Sacramento, Calif.,
July 24, 1930.

Steel-Frame Houses

Sir—The thorough analysis of steel frames for houses, prepared by T. J. Foster, National Bridge Works (*Engineering News-Record*, Jan. 16, 1930, p. 96; Jan. 23, 1930, p. 141; and Jan. 30, 1930, p. 193) and commented upon recently in your editorial pages, touches upon a field of potentially immense importance. There is need for a general dissemination of experience in the field of steel-frame construction in order that subsequent work may have the benefit of experimentation and development already accomplished. For this reason studies made by the writer of a number of steel-frame houses erected during the last year or two by the Steel Frame House Co., a subsidiary of McClintic-Marshall, may contribute something of interest to both serious and casual students of the subject.

Mr. Foster has touched upon some of the economic aspects of the problem of residence construction, in particular the simplification and speeding up of construction through the use of steel and the adaptation of various finishing materials for more economical use in conjunction with steel members. Other matters, such as the attitude of insurance and mortgage companies to steel-frame dwellings, and more particularly the experience of home owners and the reaction of prospective buyers, must be considered when appraising the merits and advantages of steel framing.

Of prime importance is the question, "Will mortgage companies make favorable loans on steel-frame houses?" An insurance company, which lends many millions of dollars annually upon small homes, investigated all types of steel framing during a study to determine its attitude toward a loan application for a house built under the Steel Frame House Co. system. While the construction engineer assigned to the work reported that some of the types examined were of inferior merit, the one upon which the loan application was based had his fullest approval. He recommended an appraisal approximately 10 per cent higher than for a like structure not having a steel frame. Since steel-frame construction costs approximately 10 per cent more than a wood-frame house of comparable character, this action accepted the premium paid for steel framing as a sound investment.

Insurance companies are apparently looking with favor upon well-designed steel-frame houses. A model house built in Indianapolis by the Steel Frame House Co. was granted a rate of 45c. per $100 for three years, against the prevailing rate of 55c. for equivalent wood-frame construction. In Mount Lebanon, Pa., the prevailing rate of 80c. was reduced to 50c., a differential of 30c. per $100. In Columbus, Ohio, the rate of 16c. per $100 per year was dropped to 12c. Thus the fireproof characteristics of steel framing are definitely recognized by insurance companies.

Inquiries were made of families that had lived in steel-frame houses from six months to a year and a half, with the result that several rather unexpected reactions were discovered. It was expected that there would be favorable comment about the fire safety of the dwelling, its relative stiffness and its complete absence of plaster cracks. It was a surprise to find that several of the owners commented upon the comparative soundproofness of their houses and their improved acoustical properties.

It is also significant to note the reactions of prospective buyers to the various sales arguments offered in favor of steel-frame construction. Freedom from plaster cracks obtained the most favorable reaction by far. Fire safety, diminished depreciation and maintenance costs, rigidity against vibration, soundproofness and safety during thunderstorms followed in approximately the order given.

Our studies developed one other point which was not stressed by Mr. Foster in his articles. It is generally recognized by engineers that more steel is used in the ordinary house framing than is actually required for strength, particularly where the members are employed in a manner comparable to normal wood framing. Economic considerations, however, are of more importance than any theoretical waste of steel. Ordinary building materials are designed for application over wood studs on a standard spacing of 16 in. Any steel framing that departs from this spacing immediately introduces a problem of using specially designed finishing materials or of wasting standard products that in the finished house cost more than the framing itself. The Steel Frame House Co. after exhaustive study developed structural members which correspond exactly to the wood members normally employed. The studs, sills, plates, etc., are perforated at 2-in. intervals to facilitate the application of standard finishing materials. The next logical step is not to devise new materials for covering the steel frame but merely to devise application methods of standard materials. Wide-awake manufacturers are beginning to pay attention to this problem, and some have already evolved clips and attachment devices which make the use of their materials economical.

Economic factors will, in our opinion, tend to maintain a very close similarity between steel-framing and ordinary wood-framing practice. The next stage in development will come when more manufacturers develop simple and effective attachment methods for the application of their materials to steel studs and to floor and ceiling members. To this extent our findings differ from those of Mr. Foster, who suggests that in the future steel framing will revolutionize present construction methods. When one realizes that there are some 90,000 contractors of greater or less importance who must be educated to the use of steel before it will find universal acceptance, and when it is appreciated that these men cannot change their ways even in the span of one generation, it seems evident that the evolution from wood to steel framing will follow established practices and customs and will use present-day materials for a considerable period of time because of economic rather than engineering considerations.

Tyler Stewart Rogers,
Vice-President,
Taylor, Rogers & Bliss, Inc.

New York City,
Aug. 12, 1930.

News of the Week

San Francisco Bay Bridge Report Sent to President Hoover

The final report of the Hoover-Young San Francisco Bay bridge commission covering the location, economic and engineering features of the proposed San Francisco-Oakland bridge has been completed and copies have been sent to Governor Young and President Hoover. Governor Young made the report public Aug. 7. The principal features of the proposed double-deck bridge, as outlined in the final report, consist of four 1,700-ft. spans with vertical clearance of 214 ft. Other features of the bridge project were announced in *Engineering News-Record* July 31, 1930, p. 191. Authority to construct the bridge is vested in the California Toll Bridge Authority. The next step looking toward actual construction of the bridge will be for the state to ask the War Department for its approval of such a structure as is proposed in the commission's report.

Hudson River Bridge May Require Special Legislative Session

A special session of the New Jersey legislature to enable the borough of Fort Lee to prepare for the opening of the Hudson River bridge is urged in a letter sent to Governor Morgan F. Larson, of New Jersey, by the Port of New York Authority. A statute passed last winter placed a limitation upon municipal borrowing capacity, which, it has since been found, makes it impossible for Fort Lee to install underground utilities while local highway and street approaches to the bridge are under construction and before permanent paving is laid. The Port Authority letter declared it would be little short of a calamity if Fort Lee were not allowed to proceed with this work. The cost would be about $700,000.

Changes in Engineering Positions in Baltimore

A number of changes involving engineering positions in the municipal service, Baltimore, recommended by Charles F. Goob, chief engineer, have been approved by Mayor William F. Broening and the board of estimates.

The position of assistant water engineer, formerly held by D. Benton Biser, has been abolished. Mr. Biser resigned some time ago to accept a position with the government. Several other positions also were abolished and others created. A number of increases in salaries also were granted. The abolished positions carried salaries of $14,600 and the new positions created and the increases granted represent salaries of $13,800.

Public-Works Projects in Chicago District Total $158,000,000

CURRENT public-works construction in the Chicago district, including work now under way, contracts let or contracts for which bids are soon to be asked, involve a total expenditure of more than $158,000,000. The major agencies concerned in this expenditure include the United States government, Cook County, city of Chicago, Chicago sanitary district, the several Chicago park commissions, the Chicago Local Transportation Co. and the trustees of the Century of Progress (1933 World's Fair).

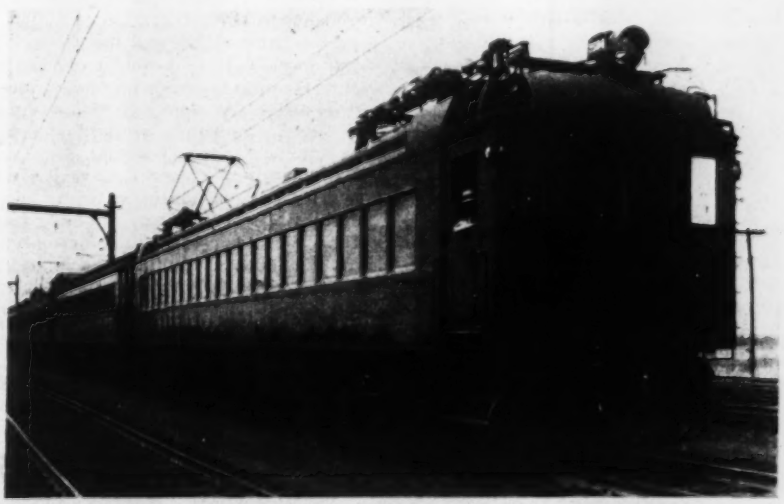
The current program of the Chicago board of local improvement entails an outlay of $38,000,000 for street widening, paving and improving and sewer construction. Of this amount nearly $20,000,000 represents the cost to the city of widening and opening three major streets to through traffic. The completion of the 1930 program of street paving will cost approximately $10,000,000. An $8,000,000 sewer extension program is well under way and

(Continued on page 268)

Oregon Hydro Project Delayed Pending City Election

Development of a $6,000,000 hydro-electric project in Oregon is being delayed pending an election to be held by the city of Salem to decide whether or not the municipality desires to construct and operate an electric system. The development involves an application of the Northwest Power Co., a subsidiary of the Pacific Northwest Public Service Co., in which the applicant seeks a permit to appropriate water and construct hydro-electric plants along the North Santiam River and at Marion Lake.

The Northwest Power Co. has completed all necessary survey work and has, according to the state engineer, met every obligation to complete its filing on both stream and lake, but now the municipality interposes with a petition asking the state to postpone granting the utility's final certificate for at least six months in order that the city may decide upon the question of public ownership and operation of hydro-electric plants at the identical locations covered by the application of the Northwest company. The power company announces it will relinquish its rights if municipal operation is decided upon.



LACKAWANNA TESTS NEW ELECTRIC EQUIPMENT

Work on the electrification of the suburban lines of the Delaware, Lackawanna & Western Railroad has progressed to such an extent that several test runs have been made with the new equipment. A short section of electrified line between Bergen Junction and East Secaucus, N. J., is being used for this purpose. Direct current, at 3,000 volts, is used to drive trains made up generally of multiples of two-car units, each consisting of a motor car and a trailer. The status of the work at present indicates that the road will put its first electric train into scheduled service about the middle of September. Line installation is about 95 per cent complete; substation construction about 50 per cent. Several of the 140 new motor cars have already been delivered. Unusually rapid acceleration and simplicity of control are features of the electrically operated trains.

Public-Works Projects in Chicago

(Continued from page 267)

is to be completed before the end of 1930.

The projects under the jurisdiction of the bureau of engineering of the city of Chicago have a total cost of $5,326,000. Anticipating favorable action by the Illinois supreme court in a friendly suit to determine the legality of a $12,000,000 issue of water certificates, the bureau is preparing to spend $4,000,000 for completion of the Chicago Ave. water tunnel. Among its other projects, the bureau will expend approximately $1,000,000 this year for the completion of the Chicago River straightening.

The superstructure of the new Wabash Ave. bridge over the Chicago River, now being erected, will cost $3,000,000.

The 1931 portion of the ten-year program of transit improvements, to be undertaken by the Chicago Local Transportation Co., will involve $25,000,000. This amount will be spent within the next eighteen months for extensions, additional tracks on existing elevated lines, new elevated railway cars and surface cars and buses.

Negotiations by the federal government toward taking over the site for a new post office near the union station are progressing to the point where it is expected that much of the $15,000,000 to be spent for the post office building can be disbursed before the end of 1931.

The new outer drive, including the bridges across the mouth of the Chicago River, is now under construction by the Lincoln Park and South Park commissions and will cost $10,000,000 to complete. Shore protection, general park improvement and the rehabilitation of the old Fine Arts Building require $18,950,000 more.

The Chicago board of education has $1,650,000 available which is to be spent on three new school buildings during 1930.

The Cook County highway commission is now carrying out a $9,250,000 program of highway improvement. Within the next three months contracts will be let for $4,750,000 worth of work. Approximately $750,000 worth of work is now under way and contracts totaling $3,000,000 are to be let this fall for work to be done in 1931.

Trustees of the Chicago 1933 World's Fair committee intend to spend approximately $2,575,000 in construction of four exposition buildings.

There is now available $16,000,000 to the Sanitary District of Chicago for carrying out its program of construction of sewage-disposal plants as required by the United States government and by the state legislature. This money will be spent within the next eighteen months and an additional sum of $16,000,000 will be spent by Dec. 31, 1931, if it can be secured from the legislature or is authorized by the people in bond issues soon to be requested.

The Illinois waterway improvements involve a federal government expenditure of $6,000,000. The state highway department intends to let contracts within the next 60 days for Cook County road improvements to total nearly $7,000,000.

Final Closure of Fifteen Mile Falls Dam at East Barnet, Vt.

At 12 o'clock noon on Saturday, Aug. 2, the Connecticut River Development Co. made the final closure of the 175-ft. concrete and earthfill dam of the Lower Fifteen Mile Falls development on the Connecticut River at East Barnet, Vt., by lowering a gate to close the upstream end of a 9x10-ft. sluice through the base of the concrete non-overflow section at the west end of the intake section. River flow was about 1,800 sec.-ft.

Closure was made Saturday noon in order not to affect operation of mills below the dam. Within a few hours the pond level had risen sufficiently to put water through the high-pressure sluices, 46 ft. above the closed diversion sluice. By Sunday morning, river flow below the dam was again normal.

The Grafton Power Co., which will operate the hydro-electric plant, has a contract to start delivery of power from this source Oct. 1, and the first of the four 39,000-kva. units will be in operation by that date. Both the Grafton Power Co. and the Connecticut River Development Co. are subsidiaries of the New England Power Association. The dam and power plant were designed by another subsidiary, the New England Power Construction Co.

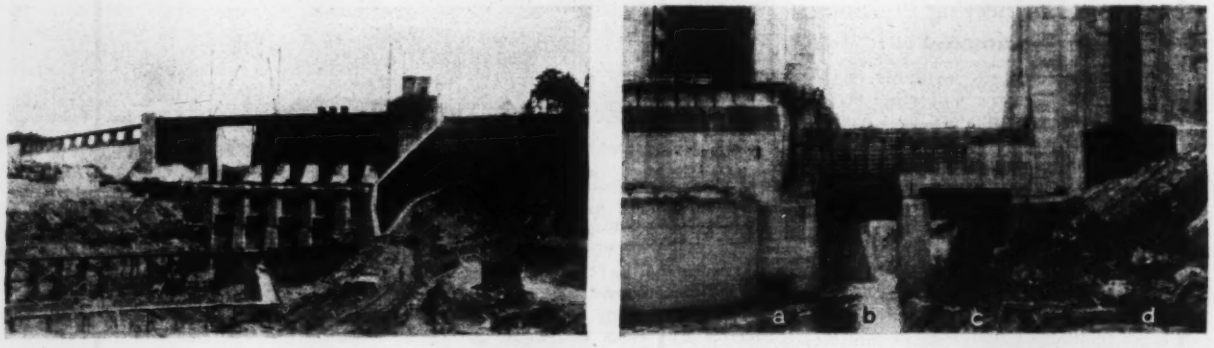
Less than 18,000 yd. of concrete remains to be placed in the dam. This concrete is being placed at the rate of 500 yd. a day.

Chicago Suburban Electrification to Be Demanded

Compulsory electrification of suburban lines and construction of new passenger terminal stations at Chicago is sought through a complaint to the Illinois Commerce Commission. This complaint alleges that the suburban service on all the railroads is inadequate (except on the Illinois Central, which already has electric operation) and can be improved only by electrification. The use of "electric locomotives" is urged, although the Illinois Central uses electric cars. Furthermore, four of the terminal stations are alleged to be overcrowded and lacking in adequate facilities for handling trains, while the new union station is said to be well operated except that the trains are handled by steam locomotives. The commission is urged to require reports from the several railroads as to plans and estimates of cost for electrification and enlargement of terminals, with a view to issuing orders requiring the companies to carry out such improvement, if the commission considers that it has power to take such action.

Court Order Permits Construction of Cheyenne Rail Yards

Construction in the near future of freight yard additions in Cheyenne, Wyo., a part of the $2,570,000 building project planned by the Union Pacific Railroad, is assured by the signing of a court order permitting the railroad to enter upon and appropriate certain property just south of the present yards. Bids for the construction of the new freight yards, which will cost approximately $1,887,000, will be opened in Omaha Aug. 14, and work will be started within ten days after the contract is awarded.



DAM OVER CONNECTICUT RIVER AT EAST BARNET, VT.

At left: The dam on July 14. One part of non-over-flow section, over diversion sluice, yet to be built. Power house in foreground. At right: *(a)* Final bypass sluice, closed Aug. 2. *(b* and *c)* Diversion sluices closed by stoplogs June 9. Photograph taken June 8. *(d)* One of two high-pressure sluices which are carrying flow today.

Queens Borough, N. Y., Considers Suspended-Car Rapid Transit

At the last meeting of the Queens Planning Commission, New York City, a report was received on plans and estimates for a novel elevated rapid-transit system of the monorail type from Frank S. Lyon, president of the Atlantic Suspended Monorail Corp. Parts of the report were also presented by N. W. Storer, chief electrical engineer, and Gilbert D. Fish, consulting structural engineer, of the Westinghouse Electric & Mfg. Co. Essentially, the suspended monorail is a continuous single rail from which cars are suspended, the bottom of the car being 15 ft. or more from the street level.

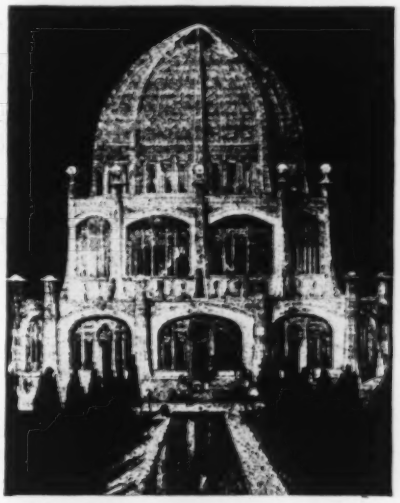
In his report, Mr. Lyon pointed to the successful use of a similar system in Germany. Built in 1900 by a German engineer named Langen, this first suspended electric railway, connecting the towns of Barmen, Eberfeld and Vohwinkel in the Ruhr, a distance of 8½ miles, has functioned efficiently and economically and has carried more than 800,000,000 passengers without an accident. During rush hours, trains of from three to six cars are operated at two-minute intervals. The system now proposed by Mr. Lyon, while based on its German predecessor, involves numerous improvements made by American engineers — typical improvements being the substitution of rolled shapes for the trussed girders on the German line, the use of a group of wheels so articulated as to be able to take a sharp curve at high speed and permit an efficient distribution of weight, the use of aluminum and duralumin for the cars and the use of four drive wheels per car. Improvements were also cited which would tend to reduce the noise of operation.

In describing a tentative design, Mr. Fish, of the Westinghouse company, recommended welded T-shaped towers along the center of the street, about 50 ft. apart, carrying on each end of the T-arm a 30-in. I-beam to support the running-rail and designed to carry cars of 64-ft. length and 30-ton loaded weight singly or in trains at speeds up to 45 miles per hour. Bids received from Jones & Laughlin Steel Co., Leake & Nelson, steel erectors, and the Fredburn Construction Co., of New York, are said to indicate that a double-track monorail, exclusive of equipment and stations, can be built for one-half to two-thirds of the average cost of ordinary double-track elevated lines as built in New York in recent years.

It is reported that the Queens Planning Commission will study the possibility of adapting this system to some of its transportation problems and will report its findings and recommendations to the engineers of the board of estimate and the board of transportation early in September. E. William Magley is chairman of the commission and John J. Halleran is commissioner of public works of Queens.

Unusual Structure to Be Built at Wilmette, Ill.

The Baha'i Temple soon to be built on the lakefront at Wilmette, Ill., promises to be a novel and interesting structure both architecturally and structurally. The foundations, a circular footing 202 ft. in external diameter, have been finished for some years. Request for superstructure bids is imminent at the present time. The building is composed of three parts, the first or main story, the second or gallery story, and the dome. It is understood that the plan as so far developed con-



PROPOSED BAHA'I TEMPLE AT WILMETTE, ILL.

templates the use of reinforced-concrete ribs with the external walls composed largely of tracery. Structural steel, reinforced concrete and glass will be utilized, with the possible addition of aluminum alloy structural shapes for the framework of the dome. The height of the first story will be 36 ft. and the total height of the superstructure 162 ft. The Research Service, Inc., Washington, D. C., F. H. Newell, president, and A. B. McDaniel, secretary-treasurer, has been retained as managing and supervising engineer. The architect is Louis Bourgeois, of Wilmette, and the structural engineer Benjamin B. Shapiro, of Chicago.

Los Angeles to Vote on Bond Issue Nov. 4

By vote of the Los Angeles board of water and power commissioners the proposed $19,000,000 bond issue to defray the expenses of a three-year construction program for power development will be placed on the ballot of the general election to be held Nov. 4, instead of on the ballot of the primary election to be held Aug. 26, as had originally been proposed. For the construction proposed $31,000,000 will be required, but of that amount $12,000,000 is to be derived from power revenues.

Major items of the $31,000,000 construction program and their cost include: two small power plants with a total capacity of 9,100 kw. in Owens Valley and a 222-mile, 110-kv., steel-tower transmission line, $4,885,000; a 14,000-kw. third unit in plant No. 2 on the aqueduct, $925,000; additions and improvements to present generation and transmission system within the city, $3,725,000; new line and receiving substation, $3,075,000; additions to city distribution system, largely preparatory to distribution of Boulder Canyon power, $14,665,000; general equipment, warehouse, shops, etc., $1,200,000; Boulder Canyon transmission rights-of-way and attendant engineering, $2,525,000.

The committee consisting of A. V. Guillou, assistant chief engineer of the California Railroad Commission; W. F. Durand, emeritus professor of mechanical engineering, Stanford University, and R. W. Sorensen, professor of electrical engineering, California Institute of Technology, which was retained by the Chamber of Commerce to investigate and report upon the proposed power program, has filed its report, and the board of directors of the chamber is expected to make its recommendations at an early date.

Aerial Mapping Aids Work of Mosquito Extermination

As a preliminary step in the extermination of the mosquito from marshland between Alameda and Alviso, Calif., aerial maps have been made of this territory by the Elliott & Duck Flying School, Oakland, Calif., with Jack Elliott as pilot. George Russell, aerial photographer, mapped about 80 square miles at low tide, in order that a study of the contour of the land could be made to determine the breeding places of the mosquito. Topographical studies of the aerial pictures will be made by the county mosquito extermination commission.

Nevada Power Companies Unite, Reducing Rates

The recent purchase of the physical property, contracts, leases and all property, with the exception of the corporation itself, of the Nevada Valleys Power Co. by the Sierra Pacific Power Co. has been approved by the public service commission of Nevada. The Nevada Valleys Power Co. maintains its headquarters at Lovelock and serves Battle Mountain, Hazen and Lovelock, Nev. The new lighting rates, which became effective July 1, when the property was taken over, are approximately 30 per cent lower than the former rates.

The Truckee-Carson irrigation district will benefit by this purchase, as the Sierra Pacific company can utilize the entire generating capacity of the Lahontan dam instead of only half, as has been done in the past. According to the public service commission, this will increase the revenue of the district approximately 40 per cent.

Inadequate Bearing for Falsework Piles Causes Bridge Collapse

The collapse of the 366-ft. span of the Trotters Landing bridge over the Tennessee River near Johnsonville, Tenn., on the night of July 9 *(Engineering News-Record,* July 17, 1930, p. 110) is believed to have been due to insufficient bearing power of the falsework piling. The portion which fell was a simple K-truss span of ten panels. Falsework bents were located under panel points, as shown in Fig. 2. When

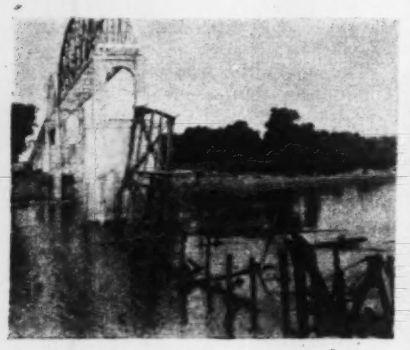


FIG. 1—WRECKAGE OF TROTTERS LANDING BRIDGE IN TENNESSEE

the failure occurred the bottom chord and floor system had been erected and riveted and four of the web members erected. This was a total of approximately 250 tons.

The steel was being erected with a steel traveler, running on the two outside stringers of the floor system, and according to the members of a gang which was working near by at the time the accident occurred, the failure started at a point under the traveler, causing the remainder of the span to follow. Damage to the piers was negligible.

No accurate data are available regarding the amount of penetration of the falsework piling or its computed bearing power, but observation would indicate that both were insufficient. During the removal of the wreckage the ends of the piling appeared to have been embedded only from 2 to 8 ft. The piles were driven in loose sand and gravel in the deepest and swiftest part of the river, and before the bents were capped one pile washed out and floated away. With so small an amount of penetration any of the piles was subject to being undermined by the current.

Salvaging operations were started immediately and were completed in two weeks. Erection of steel is expected to

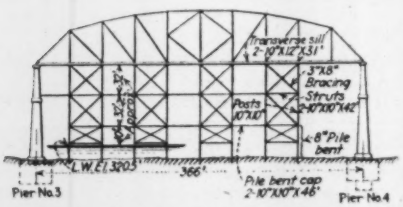


FIG. 2—FALSEWORK WHICH FAILED TO SUPPORT TENNESSEE HIGHWAY BRIDGE

be resumed by the middle of August. Delay in the completion of the structure will be about 60 days, and the loss is estimated at $40,000.

The bridge is being built for the Tennessee state highway department on state route 1, between Nashville and Memphis. The Hardaway Contracting Co., of Columbus, Ga., is general contractor and the steel contract had been sublet to the International Steel & Iron Co., of Evansville, Ind.

Revised Plans Propose Larger Dam on Columbia River

Revised plans calling for a 350-ft. instead of a 220-ft. dam on the Columbia River in the Grand Coulee will be prepared by Willis T. Batcheller, Seattle engineer, as a result of a survey of the project he has made with Elwood Mead, U. S. commissioner of reclamation. Should the plans win the approval of Mr. Mead and of Congress, $150,000,000 would be spent on the project in the next six years, Mr. Batcheler said. The lower dam and its accompanying canals and power plant would cost $50,000,000, while the higher dam alone would cost $100,000,000 and the auxiliary program would raise the cost to $150,000,000. The dam would be refinanced by the sale of power, estimated to bring in $10,000,000 annually. A 100,000-acre unit in the Quincy district, in the northwest corner of the $2,000,000 Columbia basin project, would be the first irrigated.

Steps Toward Municipal Ownership in Fresno

What is regarded as the first step toward the municipal ownership of gas and electric utilities in Fresno, Calif., was the recent announcement by officials of that city that negotiations had been opened with three large California oil companies for the purpose of obtaining options on gas lands sufficient to supply not only the gas needs of the community but the electrical needs as well. The plans contemplate the use of natural gas to generate electrical energy.

The decision to obtain proposals for options on gas property from which a sufficient quantity of natural gas may be obtained for the purpose named was arrived at by the city commission following a meeting in Tulare, Calif., at which B. F. DeLanty, general manager of the Pasadena municipal light and power department, told the city commissioners of Pasadena's successful experience in using natural gas in generating electricity. He stated that in the past 23 years the city of Pasadena has made large profits in the manufacture and sale of electricity and at the same time has provided low rates and satisfactory service to consumers, and has been able by this means to cut its tax rate down to $1.

On the day following the Tulare meeting, which was attended by the city commissioners, C. C. Van Valkenburgh, Jr., commissioner of public works, and Claude Rowe, city attorney, were instructed by the unanimous vote of the city commission to obtain the proposal for options on the gas properties.

Permit Sought for Klamath River Power Development

Applications have been filed with the Oregon state engineer for permits for the development of approximately 175,000 hp. on the Klamath River between the so-called Grant power site and the California line. The applications were filed by the California-Oregon Power Co. The cost of the proposed development is estimated at $27,600,000. Approval of the Federal Power Commission has been asked, but a state permit is necessary before this can be given.

The first of the five applications filed with the state engineer covered the appropriation of 1,500 sec.-ft. of water from the Klamath River, 200-ft. fall and development of 34,091 hp. The cost of this development was estimated at $4,000,000.

The second application also sought an appropriation of 1,500 sec.-ft., 214-ft. fall and development of 36,477 hp. This development would cost $4,500,000.

Another application covered the development of 65,455 hp. through the appropriation of 1,500 sec.-ft., with a fall of 384 ft. The estimated cost of this development was $5,500,000.

The fourth application sought an appropriation of 1,500 sec.-ft. and development of 17,045 hp. through a fall of 100 ft. The cost of this project was given at $2,600,000.

The fifth application requested an appropriation of 1,500 sec.-ft., with a fall of 166 ft., for development of 22,295 hp. The cost of this development was estimated at $4,000,000.

Minneapolis Appeals Order for C.M.St.P.&P. Elevation

The city of Minneapolis has appealed to the district court to set aside the recent order of the state railroad and warehouse commission to require the Chicago, Milwaukee, St. Paul & Pacific R.R. to elevate its main line from the station to East 24th St. The order specified that the railroad was to pay two-thirds and the city one-third of the total cost, estimated at $4,500,000. The city had previously passed an ordinance demanding that the railroad depress its tracks for this distance at the entire expense of the railroad. Depressing the tracks instead of elevating them is preferred by the city because of appearance through the heart of the city. The city cites the fact that both the Great Northern and the Northern Pacific bore the entire expense of elevating their roads through the city. If the commission's order is set aside, the city hopes to obtain the commission's authority to enforce the ordinance requiring the road to depress its tracks.

Harbor Projects Under Way in Canada

A contract for dredging Little Cataraqui Bay, near Kingston, Ont., has been awarded by the Canadian government to the Canadian Dredging Co., for $200,000. When the new Welland ship canal is officially opened on Sept. 1, the freighters of the upper lakes may take their cargoes directly to that city, where the wheat will be transferred to smaller vessels to continue to Montreal. A 2,500,000-bu. unit of the Canada Steamship Lines' elevator at Kingston is being built this year.

Deepening of the St. Lawrence ship channel above Brockville is likely to be delayed for several months as a consequence of the loss of the drill ship "J. B. King," which was struck by lightning on June 26, resulting in the death of 30 members of the crew. The Narrows, in the main ship channel, is being deepened to 25 ft. and widened to accommodate the large grain carriers which will come down to Prescott with the opening of the new Welland ship canal and the completion of the new Prescott grain terminal.

Construction is to begin immediately on a new ocean pier, 627 ft. long by 177 ft. wide, at Halifax, N. S. The contract, providing for an expenditure of approximately $500,000, has been awarded by the Halifax harbor commission to the Standard Construction Co. There will be 33 ft. of water at the pier.

Causeway to Join Point Isabel, Tex., With Padre Island

The contract for the construction of a concrete causeway across Laguna Madre to connect Point Isabel, Tex., situated on the mainland, with the lower extremity of Padre Island has been awarded to the General Engineering & Development Corp., of New York, by the Port Isabel Bridge Co., Inc. The structure will cost approximately $1,000,000. The same company was also given the contract for the erection of a hotel to cost $500,000 on Padre Island as a part of a seaside resort now being developed there.

New York State Economic Council Organized

The committee of twenty-five appointed at the New York State-Wide Economic Congress held in September, 1929, to study the situation caused by the relative halt in the economic development of New York State and to seek and recommend adequate remedies announces the creation of the New York State Economic Council. The council purposes to take a keen interest in all legislative activities, and to investigate taxes, public expenditures and all those factors that have contributed to the decline in industrial development throughout the state.

WASHINGTON NOTES

By Paul Wooton
Washington Correspondent

Power Possibilities of Potomac Are Shown by Recent Survey—Treaty With Mexico Over the Rio Grande

A REPORT of the potential resources of the Potomac River in respect to power development, navigation and flood control will be submitted to the War Department during the last part of August by the engineer officer in charge of the Washington, D. C., district. This report is part of the general survey of the nation's water resources authorized during a previous session of Congress. Under the general survey, the army engineers are directed to report on power possibilities, flood control, irrigation, reclamation and navigation. In the case of the Potomac, however, only the part of the study concerning power development and navigation is of particular value.

While the details of the report are not available, it has been established that the Potomac is one of the most promising streams in the south Atlantic section for power development purposes. According to the army engineers, this is because the Potomac is more susceptible to control, since its upper reaches flow through relatively undeveloped sections where there are no drawbacks to the construction of ample storage basins.

Treaty With Mexico Pending

A report with recommendations for levee construction along the Rio Grande was signed in Mexico City last week by members of the international boundary commission who have been studying local conditions under the chairmanship of L. M. Lawson, of California. The report has been received at the State Department but will not be made public for a few days. The findings will be used as a basis for a treaty with Mexico now pending negotiation.

Floods on the river have been a serious problem. Since the international boundary is in the middle of the stream, frequent channel shifts have been making it difficult to determine which country has jurisdiction over bancos or islands. When the river cuts across a bend, the changing border line may throw a large tract from one nation to the other.

Street and Highway Safety

In reviewing the recommendations of the recent conference on street and highway safety, officials of the U. S. Chamber of Commerce believe that particular emphasis should be placed on the proposals for engineering surveys. It is reported that city engineers have evinced great interest in the special studies suggested that have a bearing on the problem of traffic congestion. One of the proposed surveys which it is stated should receive primary consideration calls for a study of the comparative advantages and costs of the widening of radial traffic arteries from a central business area and the construction of bypass routes to relieve the central business areas of through traffic.

It is also believed that harassed engineers would be saved much unnecessary work in street widening if more attention were paid to studies of the relation between traffic and transit conditions and the trends in centralization or decentralization of the cities. In this connection the Commerce Department is making a survey in Baltimore to obtain data on the migratory trends of businesses from downtown to uptown communities. This study is being made with figures obtained over a period of three years so that it can be established whether or not the tendency of business to move to the suburbs is increasing.

Another recommended study is in connection with the factors to be considered in determining the best means of increasing street capacity. The factors entering the consideration of this problem are increasing the speed limits for vehicles, the construction of double deck highways and the provision of off-street transit facilities. It is stated that highway engineers would be spared much criticism growing out of traffic-choked streets if more consideration would be given to the provision of public and commercial off-street parking facilities.

Survey of Truck Operations

In order to obtain statistics on truck operations, the transportation division of the Commerce Department and the Bureau of Public Roads have sent questionnaire blanks to 3,500 truck operators throughout the country. Each operator has been asked to state the size and number of his trucks and trailers, the total mileage of his operations last year, the approximate total daily mileage of his trucks and the percentage of the service that is confined to metropolitan regions.

Other questions that are asked the operators include the percentage of the traveling time that the trucks are loaded to capacity, the percentage of idle time, the proportion of night hauling to the

The Business Outlook

Business sentiment is bullish, though several statistical indicators continue to fall. Most encouraging is a rise in commercial loans — business men are borrowing for fall activity. Copper and steel markets continued steady while steel production fell off. Though general trade continues to sag under the strain of depleted purchasing power during the past few months, increased employment in automobile and textile centers is encouraging and will be effective soon over retail counters. Low money rates coupled with advancing bond prices continue to encourage business.

—The Business Week, Aug. 13.

total business, whether or not published tariffs are used and whether or not operations are carried on over fixed routes with regularly scheduled trips. By means of this last question it will be possible to determine the number of truck operators that are furnishing a common carrier service and the number that are engaged in contract hauling.

It is becoming increasingly evident that a determined attempt will be made to include trucks in the pending regulatory legislation for buses. The railroads have indicated that their freight business is beginning to be seriously affected by the encroachment of the motor truck. Some of the members of Congress actively concerned in legislation on interstate bus traffic are now taking the position that trucks will have to be regulated as well as buses.

Brief News

HIGHWAY CONTRACTS totaling $1,000,000 will be let by the Georgia state highway commission on Aug. 19.

TWO HYDRO-ELECTRIC POWER PLANTS on Alberche and La Toba rivers in Spain are to be built. The cost will be about $1,250,000, and foreign engineers will be employed in their construction.

FIVE THOUSAND MILES of South Carolina highways will be paved during the forthcoming fiscal year under contracts to be let by the highway commission.

FIELD-BOLTED CONNECTIONS are being used in the erection of an extension to the Faxton Hospital in Utica, N. Y., in order to eliminate noise. The building is being erected by the Bethlehem Steel Co., and Bagg & Newkirk, of Utica, N. Y., are the architects.

A TOLL BRIDGE over the Ohio River between Ashland and Coal Grove, Ohio, to be paid for from funds raised in a $12,000,000 bond issue recently passed in Kentucky, has been authorized. It will be built by the Kentucky highway commission.

A BUILDING CODE is being drafted for Anderson, Ind., which, although one of the largest cities in the state, has never hitherto had such a code. The city council has also authorized the employment of a building inspector, and Homer E. Duke, a general contractor of Anderson, has been appointed to fill that position.

IMPROVEMENTS in Montreal's aqueduct system to cost $1,027,555 have been authorized by the city council. One, to cost $815,523, is for the construction of two 36-in. concrete water mains extending from the McTavish St. reservoir, one along Pine Ave. to the Notre Dame de Grace upper level reservoir, and the other up the Cote des Neiges road to the Cote des Neiges reservoir. The second, to cost $212,032, provides for laying new pipes to Montreal East, to which municipality the city supplies water.

Personal Notes

HOLLAND COLEMAN, chief surveyor of the Denver office of the U. S. Forest Service, has been made chief of transportation in district 9, with headquarters in Milwaukee, Wis.

S. O. BRIGGS, PHIL S. BRIGGS and JAMES A. CAMPBELL announce their association under the firm name of the Briggs-Campbell Construction Co., with offices in Omaha, Neb. This company will succeed the firm of Briggs & Drew, which has been dissolved.

EARLE P. LUCE, of Jacksonville, Fla., has been appointed county engineer of Duval County by the board of county commissioners in place of F. M. Edwards, county engineer since 1925, who has been discharged by the board by vote of three to two. The reason given by the board for Mr. Edwards' discharge is economy. Mr. Luce will receive $1,000 a year less than the salary which Mr. Edwards received.

J. F. COLEMAN, of New Orleans, president of the American Society of Civil Engineers, has been named by Federal Judge Borah as a member of the new technical commission which will appraise the land and set compensation for rights-of-way of railroads and other public utility properties in the Bonnet Carré spillway area.

Obituary

JOHN F. COLEMAN, widely known contractor in New England, died suddenly at his home in Sharon, Mass., on Aug. 1 in his 59th year. Mr. Coleman was president of Coleman Bros., Inc., and also of the Coleman Disposal Co., which held the contract for disposal of refuse in the city of Boston. His contracting company engaged in all branches of construction work. He was one of the organizers of the New England Road Builders Association and had served as its vice-president.

ROBERT E. L. COLLIER, of Salt Lake City, died on Aug. 5 after an illness of six weeks. Mr. Collier, throughout his life, was active in engineering work in the West. As assistant city engineer in charge of construction at Salt Lake City, he superintended the building of the dams at Lake Mary and Twin Lakes in Big Cottonwood canyon. Born in Alabama in 1860, he was graduated from the Alabama Polytechnic Institute, after which he went to Montana, where he was employed in the engineering department of the Great Northern Railroad. He went to Utah during the early 90's when he became construction engineer for the Denver & Rio Grande Railroad. In this capacity he built the Sanpete branch. He was later associated with the Utah Copper Co., when the first mill of that company was built.

HANS HENDRIK RODE, known in this country and in Europe as an expert in the construction of bridges, died on July 18 as the result of an automobile accident in Tyrol. He was 45 years old. From 1909 to 1912 Mr. Rode was in charge of the construction office in New York of Gustav Lindenthal. Later he was chief engineer for the firm of Steffens & Noelle, Berlin, structural steel and bridge builders. He received his doctor's degree in the spring of 1916 from the Technical University in Berlin, and in the same year was appointed professor in mechanics at the Technical Institute of Norway. In 1924-26 Professor Rode was in America on leave of absence. During that time he supervised the redesign of three bridges at Portland, Ore., as representative of Gustav Lindenthal.

FREDERICK LUMB WANKLYN, of Montreal, died at Grimsby, England, on Aug. 3 at the age of 71. Mr. Wanklyn was born in Buenos Aires, received his technical education in England, and went to Canada toward the close of the last century. In 1903 he became chief engineer of the street railway in Montreal. In 1910 he was elected a member of the first board of commissioners for Montreal and during his term of office was instrumental in extending the sewer system and waterworks and in effecting important reforms in the health department and in street traffic control. During his term also a street cleaning department was instituted. He became associated with the Canadian Pacific Railway in 1912 as general executive assistant to the president, from which position he retired in 1925.

JOSEPH EVANS SPERRY, 76 years old, who as an architect prepared the plans for many of Baltimore's most important structures, died on Aug. 7 at his home in Baltimore. Among the more important buildings designed by Mr. Sperry were the civil and mechanical engineering buildings of Johns Hopkins University, the dispensary, Institute of Pathology, Halstead and Osler clinics, Wilmer Eye Institute and the women's clinic in the Johns Hopkins Medical School and Hospital group, Union Memorial Hospital, Johnston Children's Clinic, Bauernschmidt Memorial, Eutaw Place Temple, Chizuk Amuno Synagogue, Equitable and Calvert buildings, Emerson Hotel, Emerson Tower Building, Emersonian Apartments and the Western High School.

Society Calendar

AMERICAN IRON & STEEL INSTITUTE, New York City; semi-annual meeting, New York City, Oct. 24.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; fall meeting, St. Louis, Mo., Oct. 1-3.

AMERICAN WELDING SOCIETY, New York; fall meeting, Chicago, Sept. 22-27.

NATIONAL SAFETY CONGRESS, Chicago; annual meeting, Pittsburgh, Pa., Sept. 29-Oct. 3.

WISCONSIN SECTION, American Waterworks Association, will hold its ninth annual convention in Superior on Aug. 21 and 22. A full program of papers and discussions on water-works problems has been provided. L. A. Smith, of Madison, Wis., is secretary.

Construction Equipment and Materials

Concrete Pavement Yardage

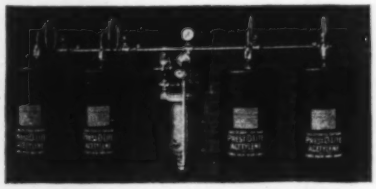
There is given below a tabulation of concrete pavement yardage awarded during the month of July, 1930, and also the total number of square yards awarded for roads, streets and alleys in the United States for the year 1930 to date as of Aug. 2:

	Sq.Yd. Awarded During July, 1930	Sq.Yd. Awarded From Jan. 1, 1930, to Aug. 2, 1930
Roads	12,719,601	77,711,488
Streets	4,284,926	20,960,714
Alleys	411,134	1,564,132
Totals	17,415,661	100,236,334

New Developments

Manifolds Distribute Oxygen or Acetylene

Economical gas distribution for small users of oxygen or acetylene is provided by two small-capacity manifolds introduced by the Oxweld Acetylene Co., 30 East 42d St., New York City. Both of these are designed for wall mounting.



FOUR-CYLINDER ACETYLENE MANIFOLD

The four-cylinder acetylene manifold shown in the illustration is equipped with valves so that each cylinder is independent of the others, making it possible to replace any cylinder without shutting off the acetylene supply. The manifold is supplied with connections for Prest-O-Lite cylinders and with Prest-O-Lite flash arresters.

The other model is a six-cylinder oxygen manifold. This is of the duplex type, so that three cylinders will maintain the oxygen supply while the other three are being changed.

Portable Reheater-Drier Uses Indirect Heat

To meet the necessity for rapidly heating and drying sand or stone, or for reheating premixed and natural asphaltic paving repair materials, the Chausse Oil Burner Co., Elkhart, Ind., has brought out a new type of portable sand drier or reheater. This consists of a rotating drum with internal cascading blades, mounted on SKF self-aligning ball bearings and inclosed in

PORTABLE REHEATER AND DRIER

a steel housing. This drum is turned by a LeRoi single-cylinder, 4-hp., radiator-cooled engine through a Twin Disc clutch, a Cotta reducing gear and a hardened roller chain. Two Chausse self-generating kerosene burners, located within the steel housing underneath the rotating drum, apply heat on the outside of the drum so that no high-temperature flame comes into contact with the material. The entire outfit is mounted on rubber-tired steel wheels with roller bearings, and is equipped with a steel towing tongue. Kerosene is stored in a 30-gal. welded steel tank and pressure is supplied by a 3-in. hand-operated air pump. The machine is available in several sizes and capacities.

Deep-Well Pumps Equipped With Anti-Friction Bearings

Several interesting features are included in a series of deep-well turbine pumps recently announced by Wintroath Pumps, Ltd., Alhambra, Calif., in capacities ranging from 25 to 6,000 gal. per minute, with ratings of from 3 to 400 hp. The standard pumps are directly driven by an electric motor, but they may be modified for belt drive by gasoline or oil engines. They can be used either on shallow wells or on those exceeding 500 ft. in depth, where the internal diameter is 6 in. or over. In addition to lifting they can be used as boosters against any desired pressure above ground.

The two main parts consist of the pump head and the impeller mechanism.

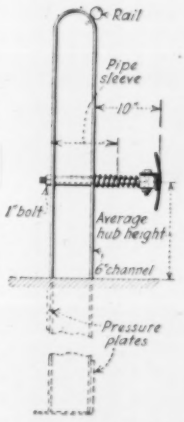
DEEP-WELL TURBINE PUMP WITH DIRECT ELECTRIC DRIVE

The former consists of a cast rotor squirrel-cage vertical-type induction motor, which is connected to the impeller by a sectionalized lineshaft. The weight of the rotor, shaft and impellers is carried by a Timken thrust bearing mounted on the lower end of the rotor shaft. Another anti-friction bearing is used as a guide bearing at the upper end of the shaft. For lubrication there is an oil bath or reservoir surrounding the thrust bearing and extending downward into the discharge chamber of the head. Thus the oil is kept at constant temperature by the cooling action of the discharged water. Oil from this reservoir is pumped to the upper, or guide bearing, whence it flows back to the reservoir. Lineshaft bearings and pump bearings are lubricated from an individual oil reservoir, which, in pumps up to 75-hp. rating, is located in the head, directly above the discharge fitting.

The pump proper is of the multi-stage centrifugal type, fully inclosed. It is provided with a suction strainer consisting of galvanized half-round wire wound around a conical steel framework with the flat side out. This makes it impossible for gravel or other foreign matter to lodge in the openings.

All-Steel Road Guard Cushions Collision Shock

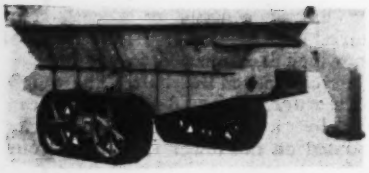
Protection to automobiles, passengers and fence alike is provided in the Standco highway guard, of all-steel construction, developed by the Standard Iron Works, 928 Penn Ave., Scranton, Pa. This consists of a 10x⅛-in. steel plate to which is welded a 2½x2-in. steel reinforcing angle, which is placed lengthwise along the road at the height of the average wheel hub and supported by 1-in. bolts, spring mounted, connected to vertical posts. Pressure plates are provided at the ground level and at the bottom of the posts, and a top rail guards against the possibility of an overturn. This rail, which is continuous, is of 1⅝-in. pipe. The posts are made of 6-in. steel channels with rounded tops.



HIGHWAY GUARD

Dump Trailers to Be Distributed Over Wide Territory

Sale of the Smith bottom-dumping trailers, manufactured by the Smith Trailer Corp., Syracuse, N. Y., has been taken over by the J. D. Adams Co., Indianapolis, Ind., in all territory covered by direct factory representatives, which includes the greater portion of



CRAWLER DUMP TRAILER WITH STRAIGHT SIDES

the United States and Canada. These trailers come in both crawler and round-wheel types, with capacities from 5½ to 8½ cu.yd., for use with either elevating graders or shovels. The bodies are of all-riveted construction, reinforced with heavy railroad car bulb angles. Material carried in the straight-sided portion of the body dumps even when it is very sticky, and this action breaks up any arch which may have formed across the sloping sides. The cable wind-up mechanism operates through reduction gears by means of a handle at the rear of the body. Chain hinges are used on the dumping doors. The crawler trailers are equipped with Amsco tracks, made by the American Manganese Steel Co.

Tamping Roller Compacts Fills

In building earthfills it is a frequent requirement that the earth be spread in thin layers and then thoroughly compacted by rolling. To meet this compacting requirement the American Tractor Equipment Co., Oakland, Calif., produces the Ateco tamping roller for use in connection with Caterpillar tractors. The roller consists of two hollow, watertight cylinders, each 48 in. in width, to which are welded 112 ball-foot castings. For normal work, the weight of the unit, 5,485 lb., provides 665 lb. of weight on each foot. When greater weight is required the cylinders may be filled with water, increasing the total weight to approximately 8,800 lb. and the unit weight per foot to 1,080 lb.

As a separate unit, the tamping roller is provided with a removable cross-beam and slip tongue for attachment to the tractor. If desired, however, the roller may be used in conjunction with the Ateco dirtmover (described in *Engineering News-Record*, Nov. 14, 1929, p. 791) by removing the wheel assembly of the latter and substituting the roller. With this combination the material is tamped as it is spread.

TAMPING ROLLER USED IN CONJUNCTION WITH HYRAULIC-OPERATED DIRTMOVER

Costs and Contracts

E. N.-R. Index Numbers

Cost			Volume		
Aug. 1,	1930	200.95	July,	1930	326
July 1,	1930	200.95	June,	1930	324
Aug. 1,	1929	205.91	July,	1929	320
Average,	1929	207.02	Average,	1929	317
Average,	1928	206.78	Average,	1928	287
1913	.....	100.00	1913	.....	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Aug. 14, with some comparisons, total as follows:

(In Thousands of Dollars)

	Aug. 14, 1930	Aug. 7, 1930	Aug. 15, 1929
Buildings:			
Industrial	$1,326	$8,211	$2,866
Other	12,507	52,659	22,579
Streets and roads	14,214	13,270	6,964
Other eng. constr.	20,886	34,447	19,829
Total $48,933	$108,587	$52,238	

Total, all classes Jan. 1 to Aug. 14:

1930	$2,271,800
1929	2,723,334

Power Transmitted by Multiple V-Shaped Belts

Collaboration between the Worthington Pump & Machinery Corp., Harrison, N. J., and the Goodyear Tire & Rubber Co., Akron, Ohio, has produced a new type of power transmission

V-BELT DRIVE ON COMPRESSOR INSTALLATION

known as the Multi-V-Drive, which will be marketed by the former company. This consists of a number of endless molded V-belts running in V-grooved sheaves. It combines a new type of rubberized cord V-belt, impervious to dust and moisture, with an improved V-grooved sheave. In the belt the load-carrying members are high-grade cotton cords arranged in parallel lines and concentrated about the neutral axis. Each sheave is carefully grooved, machined and finished so that the grooves present a smooth surface on which the belts run. The wedging action between the belts and the grooves results in a slipless, powerful grip which compensates for, but differs from, initial belt tension in a flat belt drive. The combination gives a positive grip without binding or backlash which is said to transmit about 99 per cent of the applied power at high-speed ratios over short centers without idlers. Each application is so engineered that, should one of the belts be ruptured, the remaining belts will carry the load until replacement is made.

New Publications

Construction and Industrial Equipment—A 340-p. illustrated general catalog has been issued by the SUPERIOR SUPPLY CO., 1815 S. Kostner Ave., Chicago, Ill., distributor of equipment for construction and industrial use.

Chlorinators—Bulletins describing Paradon dry feed chlorinators in both standard and portable types have been issued by the PARADON MFG. CO., Arlington, N. J.

Car Retarders—Colored and plain photographic views of car-retarder installations in a number of freight yards, and also at a car-dumper plant with 10 per cent grade, are given in bulletin 143 of the Union Switch & Signal Co., Swissvale, Pa.

Tractor Equipment—Earth-moving, road-maintenance and snow-removal equipment for use with tractor power is described and illustrated in a 32-p. general catalog, No. 280, issued by the BAKER MFG. CO., Springfield, Ill.

Water Treatment—The use of activated carbon as a water purifier is taken up and thoroughly discussed in one chapter of a 36-p. booklet by C. L. Mantell, consulting engineer, which is being distributed by the INDUSTRIAL CHEMICAL SALES CO., INC., 230 Park Ave., New York City. In addition to water purification, other chapters relate to the use of activated carbon as a purifying agent in industrial applications.

Business Notes

BRANSON SYSTEM, INC., engineers, Chicago, reports the election of E. C. DeWolfe as president and treasurer, to succeed S. J. Branson, resigned.

CHICAGO MILL & LUMBER CORPORATION has appointed M. C. Jensen, until recently supervisor of Weatherwood sales in the New York zone, successor of W. H. Badeaux in the company's Northwest district, with headquarters in Minneapolis. Mr. Badeaux left a few weeks ago to take a position with Simmons Millwork, Inc., Minneapolis, Minn.

CAST IRON RESEARCH ASSOCIATION—The standardization and development committee of this association has retained J. R. Dangler as secretary to look after all standardization and development work of the cast-iron pipe industry. His office will be located at 923 Union Trust Building, Cleveland, Ohio. Mr. Dangler was formerly vice-president and general manager of the Massillon Iron & Steel Co. and later was assistant to the president of the Central Alloy Steel Co., of Massillon, Ohio.

CONTRACTORS MACHINERY CORPORATION, BATAVIA, N. Y., announces that Samuel J. Hunt, formerly sales manager for the Wiard Plow Co., has assumed the duties of vice-president and general manager of sales. The company will manufacture and sell Trojan tractor equipment and contractors' tools. The Contractors Machinery Corporation is a recently organized company which has purchased the property and business of the Ferguson-Allan Co., which has been dissolved. The new company will offer to the trade grade rippers, automatic revolving scrapers, stone spreaders and other contractors' tools, together with rebuilt power units such as shovels, cranes, rollers, pavers and compressors.

CHARLES E. HAYNES, vice-president and superintendent of the Acme Road Machinery Works, of Frankfort, N. Y., died suddenly at his home on Aug. 5. He was 68 years old. For thirteen years he was head of the West Shore Railroad shops in Frankfort, and later joined the Remington Arms Co. and finally the Acme company.

Unit Prices From Current Construction Bids

Bridge Replacement at Plattsburgh, N. Y.

BRIDGE St. crossing over the Saranac River at Plattsburgh, N. Y., includes removing the present two-span lenticular truss bridge built by the Berlin Iron Works in 1884 and building a three-span reinforced-concrete arch bridge with stone facing. Because of the desirability of maintaining traffic, speed of construction is an important factor in this contract. Although work was started early in June, the old bridge will not be closed to traffic until Sept. 2, by which time the outer 11-ft. 10-in. sections of arch ribs and the spandrel walls are to be completed, after which the old bridge will be removed, the center arch rings will be poured, and the fill and paving placed. Thereafter, until completion, the city will have to maintain detours, the cost of which is proportionate to the length of interruption. Therefore, if the roadway pavement is not completed by Oct. 20, the contractor is assessed $50 for each day's delay. The construction schedule is as follows:

June 9—Commence.
July 15—Complete piers and abutments in so far as present structure permits.
Aug. 1—Complete east section of arches.
Aug. 30—Complete west section of arches.
Sept. 2—Close present bridge.
Oct. 20—Road paving, sidewalks and curbs completed.
Nov. 10—Open to vehicular traffic.

The entire structure, including retaining walls, is 305x52 ft. by 25 ft. above datum. Concrete is as follows:

	Mix	Min. Bbl. Cement Per Cu.Yd.
Piers, abutments and walls	1:2½:5	0.25
Arch rings	1:2:4	1.50
Paving and curbs	1:1½:3	1.75
Sidewalks, 4-in. base, 1:2½:5; topping	1:2	....

Excavation—Item 1 covers the removal of rock and concrete by explosives; item 2 covers loose rock, earth, stone masonry, asphalt paving and present stone curb. These items do not include removal of present structure between backwalls.

Fill—Item 6 is for furnishing and placing sandfill above arch rings and between spandrel walls. Item 7 is for earthfill between the new retaining wall and the present wall at the southeast corner of the bridge. Waterproofing with Inertol all concrete surfaces against which fill is placed is included in items 3 and 4.

Drainage—Item 13, lump sum, includes two 4-in. cast-iron pipes per pier and two 4-in. pipes for draining sandfill.

Temporary Sidewalk—Item 14, lump sum, is for placing a sidewalk (see drawing) at the start and removing it after completion of sandfill. The procedure is first to remove the south sidewalk from the present bridge and construct the south 11-ft. 10-in. width of the new structure, and on this place a temporary sidewalk. The same operation is then performed at the north end.

NEW BRIDGE AT PLATTSBURGH, N. Y.

	A	B	C
200 cu.yd. rock excav.	$2 00	$6 00	$5 30
600 cu.yd. earth excav.	1 00	1 66	2 41
1,500 cu.yd. conc., 1 2½ 5	11 95	12 00	13 92
550 cu.yd. conc. in arch rings	16 75	26 00	27 19
470 cu.yd. stone masonry	54 00	62 00	71 00
1,250 cu.yd. sandfill	1 00	1 10	1 77
60 cu.yd. earthfill	50	2 16	1 45
1,450 cu.yd. conc. paving	2 00	2 90	3 79
700 cu.yd. conc. curb and gutter	1 00	1 70	2 53
450 cu.yd. conc. sidewalk	1 35	1 74	2 35
120,000 lb. reinforcing steel	03	0465	06
Removing present structure (lump sum)	1,000 00	1,190 00	1,606 00
Bridge drainage (lump sum)	500 00	800 00	1,173 00
Temporary sidewalk (lump sum)	500 00	580 00	2,530 00
Totals	$64,605	$79,469	$94,843

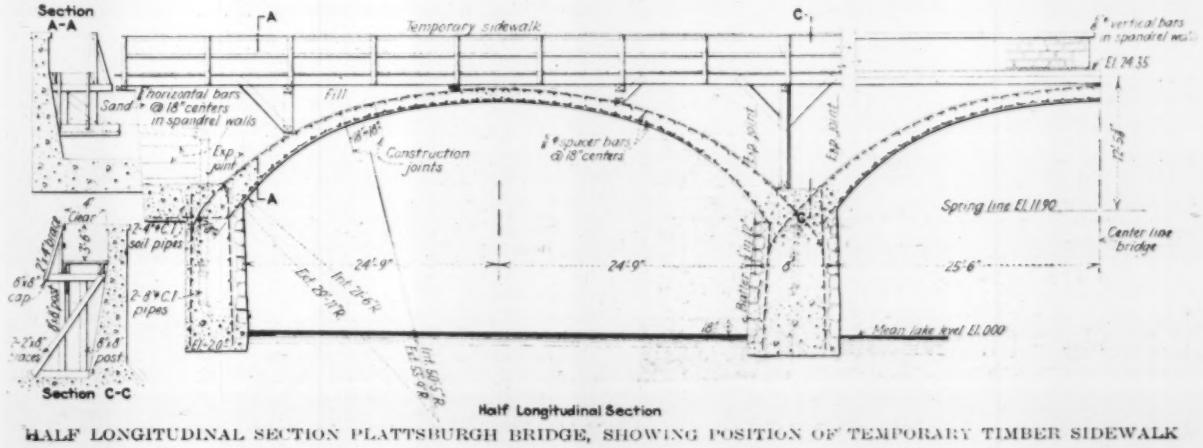
Removing Present Bridge—Item 12 is for removal of all parts, including the center pier, except the utility mains and conduits, all material removed becoming the property of the contractor.

Bidding—Nineteen bids were received and contract was awarded June 1 to the fifth, John J. Fitzpatrick & Sons, Inc., Plattsburgh, for $79,469. The bids ranged from $64,605 to $120,355. The tabulation lists the unit prices of the lowest, fifth, and eighth bidders: (A) Leo A. Malone, Lake Placid; (B) Fitzpatrick (contract); (C) Fred T. Ley & Co., Inc., Springfield, Mass.

Building New Pier on Site of Old Over Vehicular Tunnels, New York

CONSTRUCTION of Pier New 34, over the vehicular tunnels under the Hudson River between Manhattan and Jersey City, is divided into three parts: class 1, removal of existing structures; class 2, dredging and disposal of material; class 3, building the new pier. Classes 1 and 3 were bid in lump sums; class 2, in cents per cubic yard, scow measurement. The three classes were let as contract 1,959 in May, 1930, to Allen N. Spooner & Son, Inc., Pier 11, North River, for $792,037.

Pier New 34 will connect the outer end of the old pier around the ventilating shaft of the tunnels (Figs. 1 and 2) to the bulkhead wall at West St. Including the 183-ft. 7½-in. outer end, which will remain, the new structure will be 160x1,025 ft. by 10 ft. above mean low water. Fig. 2 is a pile plan. The central portion of the new pier for a width of 96 ft. has reinforced-concrete piles capped with reinforced concrete, supporting steel plate girders incased in concrete, on which the reinforced-concrete slab is placed. The northerly and southerly sides are of standard wooden pier construction consisting of reinforced-concrete slabs resting



HALF LONGITUDINAL SECTION PLATTSBURGH BRIDGE, SHOWING POSITION OF TEMPORARY TIMBER SIDEWALK

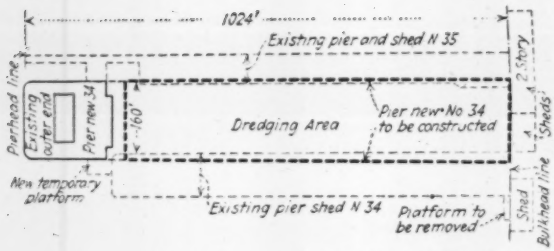


FIG. 1—GENERAL PLAN OF PIER 34 PROJECT

on wood caps spiked to wood piles, with proper bracing. The procedure of the entire job, which is to be completed in 400 consecutive days, is laid down in six steps:

1. Construct temporary platform 31x50 ft. (shown in Fig. 1) consisting of 3-in. deck on 10x12 caps on piles.

2. Remove pier and shed No. 35 (Fig. 1) and corresponding bulkhead. Piles are to be pulled and no material may sink or drift. Any water or gas pipes or electric conduits will be removed by the city or by the private corporations owning them.

3. Dredge pier area to El. —10 (but not more than —12) ft. below datum. Spoil consists of about 28,000 cu.yd. mud, hard bottom and riprap.

4. Construct portion of new pier without disturbing pier and shed of present No. 34. Extreme caution is necessary, of course, to avoid damage to the tunnels and ventilating shaft. Concrete piles, precast on job, are 65 to 75 ft. long; wood bearing piles, 80 to 95 ft.; oak fender piles, 55 ft. All concrete piles are driven to grade by steam hammer and jet. Along the timber portions of the pier, beginning at the first pile-row from the bulkhead, every pile-row is braced with two or more inclined piles. The foundation platforms are 4-in. planking on caps on piles. A 12x12-in. side-cap extends along the sides. Side-caps, caps and side rangers, and fish plates are treated with 12-lb. creosote oil. Fire walls of wood planking are built across the full width of the timber portions of the pier, extending from the horizontal brace to a height 3 ft. above datum. Above this, to the under side of the deck, the walls are 6-in. reinforced concrete resting on a 6x6-in. timber sill.

5. Remove pier and shed of No. 34, temporary platform, inshore platform, and bulkhead sheds.

6. Complete construction of new pier.

Bidding—Nine contractors bid on all three classes of the work, as follows:

	Class 1 Removal	Class 2 Dredging	Class 3 Construction	Totals
Allen N. Spooner & Son, Inc.	$64,000	$0.58	$16,240	$711,797	$792,037
The Tilt-Hargan Co.	59,800	.47	13,160	726,740	799,700
J. Rich Steers	74,500	.80	22,400	758,300	855,200
Lane Ogle, Inc.	116,500	.50	14,000	758,300	888,800
Phoenix Construction Co.	107,900	.70	19,600	762,200	889,700
Frederick Snare Corp.	70,000	.55	15,400	817,000	902,400
G. W. Rogers Construction Corp.	78,450	.49½	13,860	852,501	944,811
P. T. Cox Contracting Co., Inc.	77,000	1.00	28,000	866,251	971,251
Montrose Contracting Co.	34,000	.80	22,400	976,000	1,032,403

State Road Work in Iowa

IOWA state highway department opened bids on May 13, 1930, on seven projects totaling 47.67 miles and $802,640. Unit prices are given below of the lowest two bidders on two of these projects, in Henry and Washington counties. The lowest bids, by Booth & Olson, Inc., Sioux City, were, respectively $32,656 for 1.712 miles and $148,787 for 8.893 miles. Bidders B for the two jobs were: O'Neil & Sons, Faribault, on the Washington County job; William Horrabin Construction Co., Iowa City, on the Henry County job.

Type A concrete is 1:2:3½; classes 2 and 3 represent gravel and limestone; CA means coarse aggregate. The flumes are to carry off stormwater; type A is concrete; type B has a concrete bottom and no sides. The curb work is on hills, and the price per foot covers whatever amount is needed.

HENRY COUNTY

	A	B
16,834 cu.yd. earth excav.	$0.33	$0.32
180,372 cu.yd. type A conc. pavement, class 2 or 3, CA.	1.41	1.48
9 type A flumes	85.00	80.00
90,369 lin.ft. shoulder finish	.10	.10
Curb, per lin.ft.	.06	.06
Conc. slope drains, per ft.	2.50	2.50
Totals	$32,656	$33,706

WASHINGTON COUNTY

	A	B
23,475 cu.yd. earth excav.	$0.38	$0.40
100 cu.yd. loose rock excav.	1.00	1.75
100 cu.yd. solid rock excav.	2.00	2.50
92,699⅓ sq.yd. type A conc. pavement, class 2 or 3, CA.	1.41	1.45
33 type A flumes	85.00	90.00
16 type B flumes	85.00	100.00
469,538 lin.ft. shoulder finish	.10	.10
Curb, per lin.ft.	.06	.10
Conc. slope drains, per ft.	2.50	2.50
Metal slope drains, per ft.	2.25	2.50
Totals	$148,787	$153,495

Storm Drain, Los Angeles

REINFORCED-CONCRETE storm drain in Vardigo Wash from Geneva St. to Louise St., Los Angeles, was bid by eleven local contractors. The lowest bid of $16,663 was 18 per cent below the second and 38 per cent below the average of the first eight bids. The largest items were 2,500 cu.yd. of reinforced-concrete main drain and 5,000 cu.yd. of excavation. The low bid and the average of the eleven bids on each of these items were $0.44 and $0.447, and $5.09 and $7.52.

Concrete Paving in Duluth

FOR job 291-2, 1¾ miles of the Calvary Road, Duluth, Minn., bids were asked June 9, 1930, for laying 20,620 sq.yd. of concrete pavement, using rock or gravel for aggregate. Low bid was $2.16 for either; second lowest, $2.28 for rock and $2.24 for gravel. S. B. Shepard is highway engineer of St. Louis County.

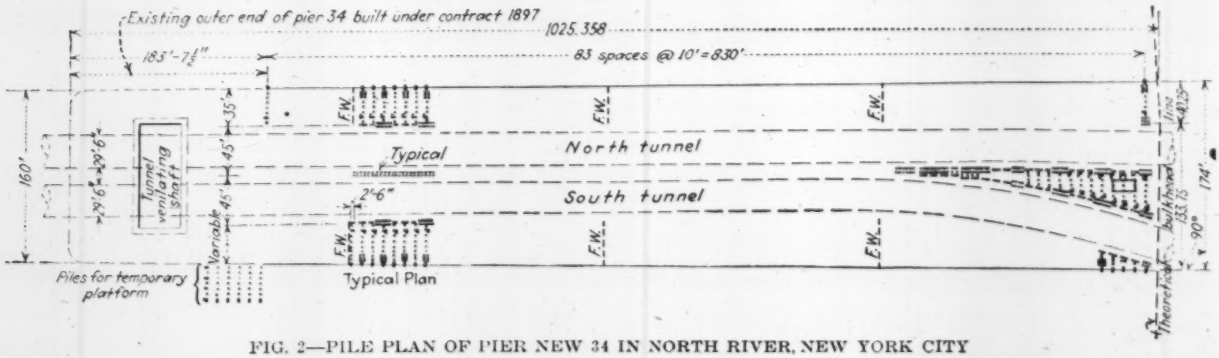


FIG. 2—PILE PLAN OF PIER NEW 34 IN NORTH RIVER, NEW YORK CITY
Fire walls on the plan are designated by "F. W."

CONSTRUCTION NEWS

Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue

Location	Project	Cost	Status
Sewers			
Tonawanda (N. Y.)	Sewers and water lines	$2,000,000	Proposed
Bridges			
Hammond (Ind.)	Viaduct	1,500,000	Proposed
St. Charles (Mo.)	Railroad bridge		Contract
Railways			
Indiana	Re-routing lines, etc.	13,000,000	Proposed
Factories and Mills			
Tacoma (Wash.)	Paper mill	2,000,000	Proposed
Buildings			
Beaumont (Tex.)	Court house	1,000,000	Bids asked
Newtown (Conn.)	Asylum	1,750,000	Contract
Malden (Mass.)	Hospital	1,200,000	Bids asked

WATERWORKS

PROPOSED WORK

Ind., Brazil — Waterworks Dpt. extending 2,700 ft. 8 in. c.i. mains. $15,000. H. Risher, Brazil, engr.

Mass., Haverhill—City, extending 8 in. main, Newton Rd. and Bway.; and 6 in. main, Willow Ave., $50,000.

Mo., Lamar—Soon takes bids water filtration plant. $20,000 voted. J. W. Hagny, engr.

Mo., Liberal—Plans waterworks system. $40,000. Shockley Eng. Co., 800 Graphic Arts Bldg., Kansas City, engr.

Neb., Snyder—J. R. Bolte, clk., rejected bids July 17. 40,000 gal. steel tank on tower, c.i. pipe, and valves. Henningson Eng. Co., Union State Bank Bldg., Omaha, engr. Noted July 10.

Tex., Barstow — Southerlin Barry & Co., (franchise holders), Canal Bldg., New Orleans, La., plan complete waterworks. $40,000. J. S. Barlow, Wilson Bldg., Dallas, engr.

Tex., Temple — City, preliminary plans, 4 m.g. probably earth and concrete reservoir, 2,000 g.p.m. electric pump, at River station. R. T. Smith, Temple, engr.

Wash., Kukwilla — City plans distributing system, for District 38. $35,000. Miller Eng. Co., Burke Bldg., Seattle, engrs.

Ont., Hamilton—For 6 in. and up, c.i. main in Oakwood Pl. from Stirling St. to Whitton Rd. $85,000. W. L. McFaul, engr.

Ont., St. Thomas—Water Comrs. enlarging and modernizing filtration system. $95,000. Gore Nasmith & Storrie, Confederation Life Bldg., Toronto, engrs.

BIDS ASKED

Calif., Calistoga — G. Koster, 2355 Leavenworth St., San Francisco, taking bids installing 25,000 g.p.d. water cooling system.

Ia., Clarinda—Aug. 19, by W. D. Toyne, city mgr., headhouse, settling basin and storage basin; 300,000 or 400,000 gal. tank on 100 ft. tower. Burns & McDonnell Eng. Co., 402 Interstate Bldg., Kansas City, Mo., engrs. Noted July 3.

Md., Baltimore — Aug. 20, by Bd. Awards, copper pipe, c.i. pipe and fittings to Bureau of Water Supply; excavating trenches, laying mains in Pennington Ave., from open street to point 2,000 ft. south. E. G. Rost, Water Engr., Municipal Bldg.

Minn., Minneapolis—Aug. 21, by F. S. Gram, city purch. agt., 6,840 lin.ft. 24 in. and 2,480 lin.ft. 8 in. c.i. water pipe and eight 12 in., four 16 in., two 24 in. and three 48 in. gate valves. N. W. Elsberg, city engr.

N. Y., Bay Brook—Aug. 28, by Executive Dpt., Div. Standards & Purchase, water supply at New York State Hospital for Treatment Incipient Pulmonary Tuberculosis; adv. E. N.-R. Aug. 14.

N. Y., Saline—Aug. 22, by H. R. Starbird, engr., 317 First Trust Bldg., Syracuse, water-main, hydrants. $30,000.

Okla., Marlow—Aug. 22, by G. L. Orr, city clk., 14,000 ft. 10 in. c.i. pipe, new concrete reservoir and flow line. $50,000. Long & Co., Colcord Bldg., Oklahoma City, engrs.

O., Youngstown—Sept. 19, by Bd. Directors Mahoning Valley Sanitary Dist., City Bank Bldg., Meander Creek Water Purification and Pumping Works, Contr. 29, Sects. A and B. W. H. Dittoe, ch. engr.; adv. E. N.-R. Aug. 14.

Okla., Geary—Sept. 4, by T. J. Stephenson, city clk., extending waterworks, incl. wells, reservoir, pumping equipment, two 300 g.p.m. motor driven pumps, one 250,000 gal. elevataed tank and tower, 1,000 ft. 4 in. c.i. pipe. $40,000. V. V. Long & Co., Colcord Bldg., Oklahoma City, engrs. Noted June 5.

S. D., Dell Rapids—Aug. 25, by City Council, 65,000 gal. wood or steel water tank on existing stone tower. Dakota Eng. Co., Mitchell, engrs.

Wis., Fond du Lac—Aug. 27, by City, 500,000 gal. tank; two 3 m.g.p.d. motor centrifugal pumps; one 1400 gal. per min. deep well pump. $55,000. Alvord, Burdick & Howson, 20 North Wacker Dr., Chicago, Ill., engrs. Noted July 24.

CONTRACTS AWARDED

Ia., Ridgeway — City, 6,100 ft. 2- to 6-in. mains, 40,000 gal. tank, on 75 ft. tower to C. W. Roland Co., 1347 48th St., Des Moines, $13,208; pump, to Hauley Supply & Mfg. Co., Macon City, $1,100.

Kan., Kansas City—City, pipe and fitting, Contr. 4 to United States Cast Iron Pipe & Fdry. Co., Interstate Bldg., $37,853.

Kan., Kansas City—City, valves for waterworks to Ludlow Valve Mfg. Co., R. A. Long Bldg., Kansas City, Mo., $29,920.

Ky., Sturgis—For water distribution system Sects. 1, 2 and 3, incl. water mains, service lines and elevated steel tank, to Christensen Bros., Urbana, Ill., $75,036. Noted June 5.

Mich., Detroit—Dpt. Purchasing & Supplies, J. E. Mills, chn., 735 Randolph St., two hundred each, 6 in. and 8 in. gate valves, twenty-five 10 in. and fifty 12 in. valves, to Michigan Valve & Foundry Co., Clayton and Parkinson Sts., $10,781. Noted July 24.

Minn., Minneapolis—F. S. Gram, city purch. agent, two operating tables for water department to F. B. Leopold Co., 422 First Ave., Pittsburgh, Pa., $4,400; 8,000 lin.ft. 48 in. steel water pipe, to East Jersey Pipe Co., 7 Day St., New York, N. Y., at $0.1125 per ft.

N. J., Hammonton—Bd. Water Comrs., 6 and 8 in. mains on White Horse Pike, Belleville Ave., Orchard St. and North Egg Harbor Rd. to A. Ellis Co., Moorestown, est. $15,000. J. A. Baker, engr. Noted July 10.

Tex., Beaumont—City, c/o R. Edmonds, 25,000 ft. 2 in. c.i. pipe to McWane Cast Iron Pipe Co.; 18,000 ft. 12 in. pipe, to American Cast Iron Pipe Co.; valves to, E. L. Wilson; fittings, to Mabry & Green, all foregoing of Beaumont. Noted June 12.

Tex., Big Spring—City, constructing 1 m.g. and 200,000 gal. concrete reservoirs, to Williams-Jacobson, Inc., Amarillo, $13,100.

Tex., Pelly—City, W. H. Kiser, mayor, waterworks and sewerage system, to Municipal Engineering Co., Athletic Bldg., Dallas, $82,000. Est. $85,000.

Utah, American Fork—City Council, excavating, laying pipe for waterworks to Wheelwright Constr. Co., Ogden, $16,969—pipe hauling to R. Thompson, American Fork, $1,285.

Utah, Stockton—Union Pacific R.R. Co., C. H. Mann, ch. engr., 1416 Dodge St., Omaha, Neb., pipe line and reservoir to Ryberg & Sorenson, Salt Lake City, and to Morrison-Knudsen Co., Boise, Idaho, $80,000.

Ont., Islington—Etobicoke Twp. laying 7,000 ft. 6 in. c.i. mains, to French River Contr. Co. #2 Henderson St., Toronto, 2,000 ft., to G. B. Moogk, Weston. Est. $18,000. Owner to purchase pipe and fittings. Noted July 31.

SEWERS

PROPOSED WORK

Ind., Chesterton — City Trustees, lateral sewers. $80,000.

Ind., Porter—City Council, G. W. Dahlbert clk., sewage disposal plant, $130,000.

Mich., Farmington—N. H. Power, city clk., plans 10,854 ft. 10- to 45-in. concrete or vitr. sewers, 200 ft. 10 in. catchbasin leads, 40 manholes, 13 catchbasins. G. H. Ruhling & Co., 900 Lawyers Bldg., Detroit, engrs.

N. J., Clifton—C. H. Reis, Inc., 833 Lincoln Ave., Wood Ridge, preliminary plans sanitary sewer system, in new development in Allwood Section. $180,000. Private plans.

N. J., Newton—Town Com., Town Hall 115 Spring St., reconstructing 675,000 gal. sewage disposal plant. $100,000. T. F. Bowe, 110 William St., New York, engrs. Noted July 31.

N. Y., Tonawanda—City report planned by G. B. Gascoigne, Leader Bldg., Cleveland, O., for sewer and waterlines. $2,000,000.

N. Y., Elmsford—Bd. Village Trustees, will not take bids Aug. 18, for sanitary sewers. Bids will be taken at later date. This corrects report in Aug. 7 issue.

O., Cincinnati — Comrs. Hamilton Co., constructing 17,130 ft. 6- to 12-in. vitr. clay Sanitary Sewer 87, Districts 4 and 5. $47,773. J. S. Raffety, Court House, engr.

O., Oxford — Village, extending storm and sanitary sewers in various streets. $35,000. G. B. Gascoigne, Leader Bldg., Cleveland, engr.

Okla., Kingsfisher — City plans sewage disposal plant. $25,000. C. R. Steele, Kingfisher, engr.

Tex., Temple—City plans intercepting sanitary sewer to central station of downtown system, remodeling sewage disposal plant. R. T. Smith, Temple, engr.

Ont., Hamilton—City, 1,770 ft. 27- to 36-in. concrete sewers. $30,000. W. L. McFaul, City Hall, engr.

BIDS ASKED

Ill., Chicago—Aug. 19, by Bd. Local Imprvts., City Hall, Berteau, North Cicero, North Spaulding, North Austin, North Melvina, Lowell and Nort hLong Aves. $2,970,000. A. J. Schafmayer, city engr.

Ill., Dupo—City takes bids about Oct. 1, 23,410 lin.ft. 8 and 10 in. vitr. sewer, 720 ft. 15 in. sewer, manholes, sewage force main special castings, valves, outfall basin, brick pumping station, two 5 in. centrifugal pumps, connect with vertical squirrel cage motors for Dupo Sanitary Sewer Imprvt. Dist. $99,866. Sheppard, Morgan & Schwaab, Faulstitch Bldg., Alton, engrs. Noted Aug. 7.

Ind., Oaklandon—Aug. 22, by Comrs. Marion Co., H. Dunn, aud., Court House, Indianapolis, sewage disposal plant at tuberculosis hospital, Sunnyside. $26,000.

Ia., Carroll—Aug. 20, by W. A. Arts, city clk., sewage treatment plant and equipment. Burns & McDonnell Eng. Co., 406 Interstate Bldg., Kansas City, Mo., engrs. Noted July 24.

La., New Orleans—Aug. 20, by City Council, 3,370 ft. subsurface drains in Thalia St. $26,000; 4,010 ft. Desire St. $26,000; 1,420 ft. Lowerline St. $29,000; 2,100 ft. South Roman St. $42,000; 2,390 ft. Burdette St. B. Vallas, city engr.

La., New Orleans—Aug. 20, by City Council, 5,354 ft. subsurface drain, etc. in LaHarpe St. $28,000.

La., New Orleans—Oct. 1, by Sewerage and Water Bd., at office of A. G. Moffatt, secy., 527 Corondelet St., Contrs. 116-D, 117-D and 210-D; adv. E. N.-R. Aug. 14.

Mass., Boston—Aug. 20, by Dpt. P. Wks., motor driven sewerage pump for Calf Pasture Pumping station, Dorchester.

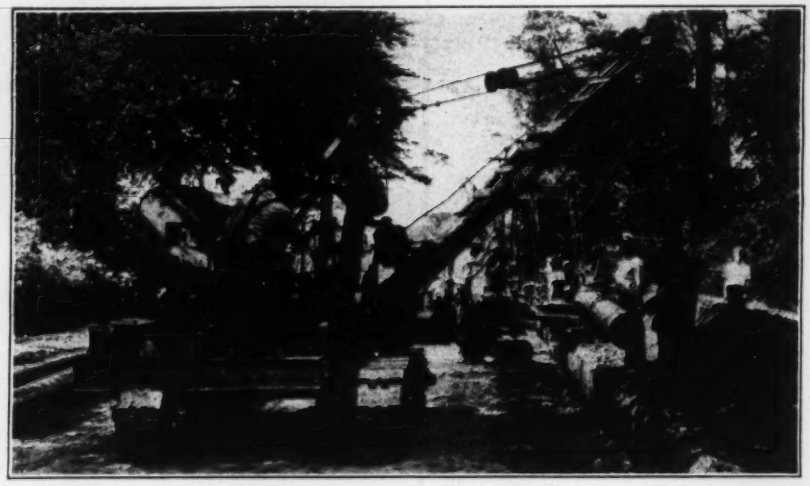
Mich., Detroit—Aug. 15, by Dpt. P. Wks., Connors Creek Outfall Sewer, 3-barrel sewer 18 ft. 6 in. x 21 ft. 9 in.; eighty-five round piles, 24 ft. long; 1,746 ft. 4 ft. 3 in. x 8 ft. 3 in. cylinder, 2 manholes; Five Point Ave. sewer north of Frisbee Ave.—reconstructing Southfield Sewer, sinking pump wells, installing pumps, pumping and lining 3,686 ft. sewer with auxiliary barrel of steel lined plates and gunite. P. A. Fellows, City Hall, city engr.

Caustic, News page 65

See proposal advertising on page 112

LEADITE

Meets practically every condition Known to Water Main Construction



Where bell and spigot water mains are laid under modern streets and roads subjected to heavy traffic, where they run across fields and open country, through swamps and forests, where they run under railroad tracks, where they run over and under bridges, under river beds, etc. . . . there are miles upon miles of these water mains jointed with Leadite.

Over a quarter of a Century's experience has definitely proven that Leadite makes an exceptionally good tight joint.

There is no exaggeration to say that thousands of miles of bell and spigot water mains of all sizes from 4″ to 84″ in. diameter and for various pressures encountered are successfully jointed with Leadite.

The Pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%.

THE LEADITE COMPANY
Land Title Building Philadelphia, Pa.

No Caulking

Sewers (Continued)

Mich., Detroit—Aug. 18, by Dpt. P. Wks., superstructure 30 x 47 ft., steel, brick, concrete Fox Creek backwater gate. $25,000. P. A. Fellows, City Hall, engr.

Miss., Jackson—Aug. 25, by State Bd. Health, complete sewage treatment plant, pumping station, Imhoff tanks, dosing tanks, trickling filters, chlorinator, outfall lines, to and from plant. State Bd. Health, Jackson, engrs.

N. J., Hammonton—Aug. 22, by Town Council, Town Hall, 4,400 lin.ft. storm sewer in Pratt, Tilton and Pleasant Street Sewer; 3,388 lin.ft. storm water sewer, in Egg Harbor Rd. and Cherry St. sewer. J. A. Baker, town engr.; adv. E. N.-R. Aug. 14.

N. C., Salisbury—Aug. 21, by J. L. Fisher, mayor and City Council, improving sewerage system, 14,800 ft. 8 and 10 in. terra cotta pipe, 38 brick manholes, 8 brick flush tanks, complete.

N. J., Far Hills—Sept. 3, by Common Council, sewage disposal plant, North Branch Raritan River. $40,000.

Okla., Geary—Sept. 4, by T. J. Stephenson, clk., 10,100 ft. 6, 8 and 12 in. vitr. clay sewers, sewage disposal plant. $37,000. V. V. Long & Co., Colcord Bldg., Oklahoma City, engrs. Noted June 5.

S. D., Brookings—Aug. 26, by City Comn., 5,500 lin.ft. 8 in. sewer and sewage pump or ejector. Dakota Eng. Co., Mitchell, engr.

Tex., Dallas—Aug. 18, by City, E. Goforth, secy., Dallas, outlet and relief sewers from Wall St. to Texas & New Orleans R.R. $274,000. Y. M. Young, City Hall, engr.

Tex., Dallas—Aug. 18, by City, E. Goforth, secy., relief sewer from C. D. Cain Sewer at Cedar and Coombes Creeks to Blue Bonnett Addition 1, then westerly to Barnard Blvd., to Vocational School property. $25,700. J. M. Young, City Hall, city engr.

Tex., Port Arthur—Aug. 26, by City Comn. and W. O. Bower, city engr., drainage pump station at Del Mar and Lakeview Sts. $300,000.

Tex., Port Arthur—Aug. 26, by J. B. Converse & Co., Port Arthur and Corpus Christi, engrs., constructing 11 blocks 9 x 10 ft. concrete box sewers, $35,000, for City, c/o J. W. O'Neal, mayor.

Wash., Port Angeles—Aug. 20, by City Comn., 10 mi. 6- to 15-in. lateral sewer in East End Dist. $90,000.

CONTRACTS AWARDED

Calif., Los Angeles—For 8-in. vitr. main sewers in Co. Impvt. 758, City Terrace Unit, to P. J. Akmadzich, 3028 Gilroy St., $72,199.

Ill., Chicago—H. E. Hoff, clk., Sanitary Dist. of Chicago, 910 South Michigan Ave., West Side Sewage Treatment works, Div. U to E. J. Albrecht, 35 South Dearborn St., $221,495. Noted July 10.

Ill., Lyons—Sewers to H. J. Hosman, Lyons, $25,601.

Ill., Rockford—Bd. Trustees Sanitary Dist. of Rockford, sewage treatment plant Div. O to J. T. Walbridge Eng. Co., 1014 South Michigan Blvd., $384,994; electrical equipment, to Sword Bros. Co., 627 7th St., $12,411. This corrects report in Aug. 7 issue.

Kan., Abilene—M. E. Calkins, city clk., City Hall, sewage disposal works to J. W. Carrothers, Topeka, $47,013. Noted July 17.

Mich., Detroit—H. I. Dingeman, drain comr. Wayne Co., Mayburn Tile Drain, 20,000 ft. 12- to 39-in. rein.-con. and vitr. pipe, diversion chamber and septic tank, to United Sewer Corp., 645 Randolph St., $34,149. Noted July 3.

Mich., St. Clair Shores—Village, storm and sanitary sewers, incl. concrete cylinders 4- to 10-ft. in diam., 2,450 ft. 30 in. corrugated pipe, 6,000 cu.yd. dredging, to J. S. Nentrelle, 516 Transportation Bldg., Detroit, $1,796,322.

Minn., Crosby — P. J. Sheets, village clk., 16,193 lin.ft. 8- to 12-in. vitr. clay pipe, to O'Neil & Preston, 607 New York Bldg., St. Paul, $24,220. Noted July 17.

Mo., St. Louis—Bd. P. Serv., City Hall, Mill Creek Sewer to Riley Contg. Co., 110 North 17th St., St. Louis, $37,125. Noted July 17.

N. Y., Long Island City—Aug. 18, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewers in 71st Pl., Cross Island, Sutphin and Woodhaven Blvd., Weisse, Nassau, 43rd, 133rd, Flattwood, 115th, 109th, and Edgemere Aves., Stoutenburgh, 192nd, 213th, 204th, 160th, 164th, 194th, 196th, 209th, 212th, Beach 35th, 134th Sts.

N. Y., New York—J. Miller, pres. Manhattan Boro, Municipal Bldg., storm sewer in West 14th St., to Cleverock, Inc., Grand Central Terminal, $28,960. Noted July 31.

N. Y., New York—W. J. Flynn, acting pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., sewer in DeWitt Pl. and Wilder Ave. to Anita Constr. Co., 410 East 200th St., $6,760 and $9,468 respectively—in Jennings St. to J. LaMarsh, 391 Fulton St., Brooklyn, $58,766. Grand total $74,994. Noted July 24.

Okla., Britton—D. A. Riley, city clk., 23,000 ft. sanitary sewer extension, to Bensen & Farrar, 402 South 2nd St., Guthrie, $58,710. Est. $59,000.

Wis., Milwaukee — D. M. McKeith, comr. sewer in North 4th St., to Wenzel & Henoch Constr. Co., 5025 State St., $214,780—South 18th St., to Pentory & Blunt, 4488 37th St., $755—and West Keefe Ave., to M. D. Beevers, 457 Mineral St., $20,421. Grand total $235,956.

Wis., Milwaukee — Dpt. P. Wks., to C. E. Stormowski, 950 Warren Ave., sewer in North 20th St., $3,002; North 59th, $3,522; North 74th, $11,214—to Wisconsin Sewer Constr. Co., 946 30th Ave., North 59th St., $427—to General Contractors, 4728 Lisbon Ave., South Rhode Island Ave., $1,644—to P. D. Johnson, 819 31st St., South 34th St., $893—to Shobart & Rouch, 1003 41st St., West Center St., $177—to Zimmerman & Zimmerman, 2826 State St., West Lancaster Ave., $4,313. Grand total $81,109.

Wis., Milwaukee — Sewerage Comn. general contract 70 x 127 ft., concrete, dryer house, pile found., to Dohlman Constr. Co., 456 Bway., $42,948.

Wis., Racine—City, 8- to 60-in. vitr. tile sewer pipe and concrete for sewage disposal plant to J. Brogan Sons, Green Bay, $279,913. Noted July 17.

Ont., Kingston—Public Utilities Comn., 400 hp. motor, 14-in. 7 m.g.p.d. pump, to Turbine Equipment Co. Ltd., 73 King St. W., Toronto. Est. $7,500. Noted May 29.

Ont., Toronto—City Council, sewers in Leslie St., Commissioners St., Sect. A., B. and C., to Nelson River Constr. Co., 124 Pears Ave., $215,000; Commissioners St. west of Carlaw Ave., to W. E. Taylor, 22 Lalcon St., $12,781.

Ont., Toronto—City Council, 8 in. and up vitr. tile storm sewers in lane near Queen St., to G. Simone, 10 Coleridge Ave., $720; 2 lanes, to Mitchell Contg. Co., 28 Moore Ave., $2,644; Leslie St. Sects. A and B, to P. Mohan, 232 Withrow Ave., $8,010; Leslie St. Sects. C and D, to Worthington Constr. Co., 57 Lascelles Blvd., $21,600. Grand total $32,974.

BRIDGES

PROPOSED WORK

Ark., DeQueen — Texarkana & Fort Smith Ry., W. G. Morgan, ch. engr., Texarkana, preliminary plans rein.-con., steel bridge across Little River at Morris Ferry.

Calif., Long Beach—City, bridge over Flood Control Channel on Anaheim St. $350,000. Hill and Orange Ave. Viaduct, $165,000—Pacific Ave. Underpass, $145,000, Recreation Park Lagoon Bridge, $20,000.

Ill., Venice—City, Terminal R.R. Association of St. Louis, H. J. Pfeifer, ch. engr., St. Louis, Mo., and Illinois Terminal R.R., E. S. Hight, ch. engr., Chicago, Ill., preliminary plans 800 ft. rein.-con. viaduct to carry Broadway over railroad tracks. $500,000.

Ind., Crown Point—Comrs. Lake Co., constructing 11 bridges. $115,000. C. K. Wallace, Crown Point, engr.

Ind., Hammond—Plans Forsyth Avenue Viaduct, over Gibson Railroad Yards. $1,500,000. R. Seely, city engr.

Pa., Pittsburgh—City soon takes bids extending Mount Washington Blvd. from Liberty Tubes to proposed Tenth St. Bridge by 2 viaducts, over Main line, Pittsburgh, Virginia & Charleston R.R. $500,000. C. M. Reppert, City-County Bldg., engr.

Pa., Pittsburgh — City plans approaches to Elizabeth Street Bridge in Hazelwood. $65,000. C. M. Reppert, City-County Bldg., engr.

Tex., Fort Worth—City, O. E. Carr, mgr., and Texas & Pacific Ry. Co., E. F. Mitchell, ch. engr., Dallas, 231 ft. rein.-con., steel viaduct, on Ballinger St.; 151 ft. concrete overpass at Summitt Ave., both over railroad tracks.

Tex., Sherman—Grayson Co., 60 ft. steel overpass, 24 ft., on Hy. 6. $70,000. J. Wilson, Sherman, assistant co. engr.

Ont., Toronto—East York Twp., 800 ft. steel span bridge on concrete piers and abutments, over Don Valley on Don Mills Rd. $400,000. G. R. Jack, 443 Sammon Ave., twp. engr., Frank Barber & Associates, 45 Jarvis St., consulting engrs. Noted June 19.

BIDS ASKED

Arizona — Aug. 27, by State Hy. Comn., Phoenix, superstructure bridges one over Mining Wash and other over Post Office Wash., on Rice-Springerville Rd., Navajo Co. W. W. Lane, state engr.

Arkansas — Aug. 19, by State Hy. Comn., Little Rock, concrete and steel bridge on Route 10, Sect. 3, F.A.P. 130-B, Havana, Yello Co. $48,000. C. S. Christian, state engr.

California—Sept. 3, by State Hy. Comn., Sacramento, seven 35 ft. span rein.-con. girder bridge, over Castaic Creek 4 mi. north of Castaic Junction, Los Angeles Co. C. H. Purcell, P. Wks. Bldg., Sacramento, engr.

Ill., Chicago—Aug. 21, by City, City Hall, operators houses and enclosure walls, for double leaf trunnion bascule bridge over Chicago River, North Wabash Ave. R. W. Wolfe, comr. P. Wks.

Kentucky—Sept. 10, by State Hy. Comn., Frankfort, concrete and steel toll bridges, over Ohio, Green and Cumberland Rivers at Ashland, Spottsville and Burnside respectively. B. Johnson, chn.; adv. E. N.-R. Aug. 15.

Kentucky—Sept. 15, by State Hy. Comn., Frankfort, steel and concrete toll bridges over Ohio, Kentucky, Tennessee and Cumberland Rivers, at Maysville, Boonesboro, point near Paducah, and at Smithland respectively. B. Johnson, chn.; adv. E. N.-R. Aug. 15.

Kentucky — Aug. 28, by State Hy. Comn., Frankfort, rein.-con. bridge, over Benson Creek, Federal Aid Project 172AB, Franklin and Shelby Co. C. H. Wood, West Main St., Danville, dist. engr.

Md., Baltimore — Aug. 20, by Bd. Awards altering east approach of Lee St. bridge over Baltimore & Ohio R.R. E. G. Rost, Water Engr., Municipal Bldg., engr.

Michigan—Aug. 20, by C. L. Cowgill, resident engr., Plymouth, 2 steel deck girder parallel bridges with 2 rein.-con. abutments each 40 ft., Assessment Dist. A. B. 1 of 63-20-20; 2 independent parallel steel deck girder bridges MB 3 of 63-20-20, 40 ft. roadway, all in Oakland and Wayne Counties, for State Hy. Comn., Lansing.

Missouri—Aug. 22, by State Hy. Bd., Jefferson City, bridges in Andrew, Christian, Clay, Cranford, Daviess, McDonald, New Madrid, Nodaway, Pettis, Phelps, St. Genevieve and St. Louis, T. H. Cutler, ch. engr.

N. H., Walpole—Aug. 21, by State Hy. Comn., Concord, two 110 ft., rein.-con. open spandrel bridge.

Tenn., Knoxville—Sept. 9, by City, at office G. R. Dempster, city mgr., rein.-con. bridge, over Tennessee River, Henley St.; adv. E. N.-R. Aug. 14.

Tex., Memphis—See "Streets and Roads."

Virginia—See "Streets and Roads."

West Virginia—See "Streets and Roads."

West Virginia — Aug. 26 by State Road Comn., Charleston, Bridges 1225, 1227 and 1228, P.-140-C, Greenbrier Co.—Bridge 1219, P.-3377, Ritchie Co.—Bridge 1198, P.-3452, Summers Co., rein.-con. and steel, E. D. Yewell, Box 1356, Charleston, engr.

West Virginia—Sept. 3 by State Bridge Comn., Charleston, St. Albans-Nitro-Bridge over Kanawha River, St. Albans; also Point Pleasant-Henderson Bridge over same river at Point Pleasant, J. E. Grenier Co., 1201 St. Paul St., Baltimore, Md., consult. engrs.; adv. E. N.-R. Aug. 14.

Ontario and Quebec—Aug. 19, by N. Desjardins, secy. Dpt. P. Wks., Ottawa, Ont., steel superstructure for Interprovincial Bridge, over Ottawa River, between Hawkesbury, Ont., and Grenville, Que. $300,000. Noted July 17.

Ont., Hamilton—Aug. 27, S. H. Kent, city clk., rein.-con. bridge connecting Paradise Rd. with Longwood Rd. Noted June 26.

CONTRACTS AWARDED

California — State Hy. Comn., Sacramento, rein.-con. girder bridge over Nojoqui Creek, Santa Barbara Co., to Silveria & Robbins, Ventura, $20,132. Noted June 19.

Conn., Bridgeport—City, E. T. Buckingham, mayor, repairing bridge, incl. realigning both lifts, readjusting machinery, building new dock, Stratford Ave., to Leake & Nelson, Ash St., $32,756, est. $34,000.

Ind., Goshen — Elkhart Co., Wilden Ave. Bridge, to Elkhart Bridge & Iron Co., Elkhart, $21,448. Est. $27,000.

Maine—State Hy. Comn., Augusta, to Edmund Cyr & Co., Waterville, Androscoggin Bridge, Mexico and Peru, $30,673—to Hector Cyr & Co., Inc., Waterville, Falls Bridge, Yarmouth, $30,521 — to Cyr Bros., Waterville, bridge, Kennebunk, $91,841—to G. W. Crane, Waterville, Thoroughfare Bridge, Twp. 17, $15,071—to Naugler Bros., Brunswick, Hiram Bridge, Cornish, $29,913; Gulliver Brook Bridge, Prentis, $5,660; Jones Bridge, $5,810—to G. W. Sweetser, Yarmouth, Main Tomah Bridge, $9,687. Grand total $219,176.

Maryland — State Roads Comn., Baltimore, bridge Queene Anne Co., to American Bascule Bridge Corp., Pensacola, Fla., $24,387—rein.-con. bridge, Group 1, Baltimore Co., to Luten Bridge Co., Clarksburg, W. Va., $6,566—culverts for construction of culvert, Group 2, same county, to Burk Bros., Phoenix, $2,918. Grand total $33,871. Noted July 24.

Maryland — State Roads Comn., Baltimore, driving timber piles, placing of caps in existing bridge over South River, on Anne Arundel Co., to Smith Bros., Galesville, $7,880. Noted July 24.

Mass., Boston — City Dpt. P. Wks., reconstructing bridge over Reserved Channel, connecting Summer and L. Sts., to Coleman Bros., Inc., 245 State St., $176,340. Noted July 24.

Minn., Minneapolis—Great Northern Ry. Co., Railroad Bldg., St. Paul, concrete bridge over Plymouth Ave., into Glenwood Park to Widell Co., Mankato. Est. $30,000. City will share cost.

Miss., Woodville—Wilkinson Co., 8 bridges, to W. R. Fairchild, Seminary, $27,400.

Mo., St. Charles—Wabash Ry. Co., Railway Exchange Bldg., St. Louis, M. F. Longwill, ch. engr., piers and sub-structure for 8,640 ft. two-track railroad bridge, to Missouri Valley Bridge & Iron Co., Leavenworth, Kan. Noted Apr. 17.

Mo., St. Louis—Bd. P. Serv., City Hll, rein.-con. viaduct over Des Peres River, at Lansdowne Ave., to G. G. Prendergast, Chemical Bldg., $87,463. Noted July 3.

Montana—Great Northern Railway Co., J. R. W. Davis, ch. engr., Railroad Bldg., Minneapolis, Minn. trestle bridge over Spring Creek to Peppard Fulton, 1004 Roanoke Bldg., Minneapolis, Minn., est. $100,000.

Neb., Odessa—Dpt. P. Wks., Omaha and Buffalo Co. bridge over Platte River and grading road to Allied Contractors, Inc., 1803 Douglas St., Omaha. $74,677 and $37,677 respectively.

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Bridges (Continued)

New York — A. W. Brandt, comr. Hys., Albany, bridge in Erie Co. to Connaran Eng. Corp., New York, $197,371 est. $239,539; bridge in Steuben Co., to M. Moogan, Wellsville, $43,820 est. $59,839. Noted June 10 and July 10 under "Streets and Roads."

South Dakota—State Hy. Comn., Pierre, bridge over Cheyenne River to Des Moines Steel Co., Southwest 4th St., Des Moines, Ia., $126,598. Noted July 24.

Tennessee—See "Streets and Roads."

Texas—G. Gilchrist, state hy. engr., Austin, **(e.e. means Engineers Estimate)**, steel and concrete bridges, Dallas Co., to J. P. Foty, Burt Bldg., Dallas, $71,625, e.e. $78,000—Caldwell Co., to G. Williams, 425½ West Main St., Oklahoma City, Okla., $108,820, e.e. $110,000—Dallas Co. to J. T. Buckner, 407 North Main St., Cleburne, $27,533, e.e. $28,000—rein.-con. bridges, Galveston Co., to L. H. Lacy Paving Co., 202 Burt Bldg., Dallas, $39,371, e.e. $44,000—McLennan Co., to J. E. Johnson Constr. Co., Waco, $55,113, e.e. $60,000—Leon Co., to E. E. Board & Son, Cleveland, $19,307, e.e. $25,000—Victoria Co., to C. W. Gilfillan, Norwood Bldg., Austin, $37,525, e.e. $38,000—Haskell Co., to Mackey & Hopper, 325 Liberty Bank Bldg., Oklahoma City, Okla., $48,999, e.e. $56,000. Grand total $408,293. Noted July 24.

Tex., Point Isabel—Point Isabel Bridge Co., c/o H. H. Poshong, pres., Brownsville, constructing 10,500 ft. steel causeway, incl. 2 drawbridges, one 100 ft. single span and other 50 ft. single span, over Laguna Madre, also constructing 5½ mi. Causeway Blvd., to General Engineering & Development Corp., 175 5th Ave., New York. Est. $1,000,000 and $150,000 respectively. Noted June 26.

Virginia — State Hy. Dpt., Richmond, steel and concrete bridges over Pagan River, Smithfield, Isle of Wight Co. and 77 ft. over Potomac Run, near Fredericksburg, Spotsylvania Co., to J. S. Bowers, Whiteville, N. C., $46,476 and $9,865 respectively. Noted July 24 under "Streets and Roads."

B. C., Hazelton—Provincial Govt., Dpt. P. Wks., Victoria, fabricating of steel super-structure for new Hagnelgate Bridge, over Skeena River, to Ross & Howard Ltd., foot of Woodland Dr., Vancouver, $58,081.

Ont., Gananoque—J. H. Sampson, town clk., 180 ft. rein.-con. bridge over Gananoque River, King St., to Holdcroft Constr. Co. Ltd., 331 Bay St., Toronto. $34,840. Est. $50,000.

Ont., Welland—Toronto Hamilton & Buffalo Ry., James and Hunter Sts., Hamilton, R. L. Latham, ch. engr., sub-structure for 235 ft. concrete, steel bridge to Dominion Constr. Co., Herkimer St., Hamilton; steel for same, to Hamilton Bridge Co., Bay St., Hamilton. Est. $120,000. Noted July 31.

STREETS AND ROADS

BIDS ASKED

Ark., Pine Bluff—Aug. 21, by Bd. Comrs., Paving Impvt. Dist., 105, at office Coleman & Gantt, attorneys, Simmons Natl. Bank Bldg., curbing, 90,000 cu.yd. concrete paving. H. R. Carter, engr.

California—Sept. 3, by State Hy. Dpt., Sacramento, grading 4.1 mi. Redwood City-Willow Rd., San Mateo Co. C. H. Purcell, hy. engr.

Calif., Laguna Beach—G. W. Prior, city clk., taking bids grading, oil or rock surfacing 1,060,000 sq.ft. Laguna Cliff-High Dr.

Calif., Los Angeles—Aug. 20, by Bd. P. Wks., curbing, walks, 7 in. concrete paving 850,000 sq.ft. Olympic Blvd. and Stanley Impvt. Dist.

Calif., Los Angeles—Supervs. Los Angeles Co., taking bids grading, alternate types paving Main St. south of Artesia; Richfield and Ocean Aves.

Calif., Manhattan Beach—City Council taking bids 136,000 cu.yd. excavation 744,000 sq.ft., 4 and 5 in. asphaltic concrete paving El Camino Real.

Calif., Richmond — A. C. Faris, city clk., taking bids grading, asphaltic concrete paving portions Pullman Ave. To exceed $25,000.

Iowa—Aug. 19, by State Hy. Comn., Ames, grading 0.695 mi. P-289-B, Crawford Co. — paving 7.225 sq.yd. F-520 and 42,889 sq.yd. F-64, Jasper Co.—2,423 sq.yd. F-206, Polk Co. —575 cu.yd. stone riprap, F-306, Des Moines Co.— 250 cu.yd. F-219, Henry Co.—400 cu.yd. rock riprap, P-578, Washington Co. — 127,370 lin.ft. cable guard rail, Dist. 1, various counties. R. F. White, hy. engr.

Ia., Estherville—Aug. 18, at office Auditor, Emmet Co. 1,000 ft. road bed at crossing East Fork Des Moines River, between Secs. 26 and 35, Lincoln Twp.

Kansas—Sept. 5, by State Hy. Comn., Topeka, concrete paving 3.631 mi. U. S. Hy. 40, F.A.P. 203 B, and 1.508 mi. U. S. 40, F.A.P. Pottawatomie Counties—and 5.117 mi. U. S. Hy. 40, F.A.P. 335 J and 5.457 mi. U. S. Hy. 40, F.A.P. 335 J, Shawnee Counties. W. V. Buck, engr.

Kan., Kansas City—Aug. 25, by O. K. Williamson, co. clk., paving Broadview Pl., Sect. B, $25,000.

Louisiana—Aug. 26, by State Hy. Comn., Baton Rouge, grading, surfacing 29.8 mi. in Beauregard, East Carroll, Franklin, Jefferson, Lafourche, Rapides, Red River and Saline Parishes.

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La., New Orleans—Aug. 19, by City Council, grading, curbing, alternate types paving 17,974 ft. 5 streets. B. Vallas, city engr.

La., New Orleans—Aug. 19, by City Council, concrete paving 1,360 ft. Derbigny St. $26,000—various types paving 4,010 ft. Desire St. $50,000—2,390 ft. Burdette St. $30,000. B. Vallas, city engr.

La., New Orleans—Aug. 21, by City Council, 5,314 ft. concrete sidewalks on LaHarpe St., $30,000—3,370 ft. on Thalia St.—4,930 ft. on Tolouse St. $25,000. B. Vallas, city engr.

Maryland—Aug. 19, by State Roads Comn., Baltimore, macadam resurfacing 0.65 mi. Contr. Q-60-24, Queen Anne Co.—concrete paving 1.23 mi. Contr. H-98-44 Harford Co. — 2 timber jetties, Contr. Wo-85-15, Worcester Co. H. Williar, Jr., Federal Reserve Bank Bldg., Baltimore, engr.

Massachusetts — Aug. 19, by Dpt. P. Wks., State House, Boston, bituminous macadam paving 13,286 ft. hys. in Amherst and Pelham—gravel and bituminous macadam paving 2,200 ft. Holliston—4,700 ft. Berkley—bituminous concrete paving 3,970 ft. Nantucket. A. W. Dean, Dpt. P. Wks., Boston, engr.

Mass., Franklin—See "Contracts Awarded."

Michigan — Aug. 19, by R. W. Roberts, resident engr., 504 Eddy Bldg., Saginaw, grading, graveling, 2.701 mi. Mo26-16, Contr. 1, Gladwin Co., 21 ft., for State Hy. Comn., Lansing.

Michigan—Aug. 21, by E.: R. Benkert, resident engr., 205 Merier Bldg., Port Huron, concrete paving 10.931 mi. Fo-77-32, Contr. 1, 20 ft., St. Clair Co., for State Hy. Comn., Lansing.

Michigan—Aug. 20, by E. D. Crandall, resident engr., Cadillac, sheet asphalt surfacing 11.927 mi. MO28-20C-5 and 21C-2, 18 ft., Grand Traverse Co., for State Hy. Comn., Lansing.

Michigan—Aug. 26, by R. A. Beers, resident engineer, Kalamazoo, grading, concrete paving 18.502 mi. Rds. F011-9-C-1, M011-9C-2, F080-4C-1, FA-148, Sect. A and B, 20 ft. Van Buren and Berrien Counties, for State Hy. Comn., Lansing.

Michigan—Aug. 27, by E. H. Haahr, resident engineer, Newberry, grading, shaping, waterbound macadam or gravel surfacing 8.172 mi. Rd. M075-22C-1, 18 ft., Schoolcraft Co., for State Hy. Comn., Lansing.

Michigan—Aug. 27, by C. L. Cowgill, resident engineer, Plymouth, grading, shaping, concrete paving 2.468 mi. Rd. 058-19C-1, 20 ft., Monroe Co., for State Hy. Comn., Lansing.

Michigan — Aug. 27, by E. H. Haahr, resident engineer, Newberry, grading crossing of Duluth, South Shore & Atlantic R.R., Rd. 017-5-Contr. 3, Chippewa Co., for State Hy. Comn., Lansing.

Missouri—Aug. 22, by State Hy. Bd., Jefferson City, improving roads in Andrew, Caldwell, Cranford, Daviess, Dunkin, Holt, Linn McDonald, New Madrid, Nodaway, Osage, Pettis, Phelps, Platte, St. Genevieve, St. Louis, and Scott Counties. T. H. Cutler, ch. engr.

Nevada — Aug. 20, by Directors State Hy. Dpt., Carson City, grading, asphaltic fuel oil 20.22 mi. Crystal to west slope Mormon Mesa, Route 6, Sect. F, Clark Co.—grading, crushed rock or graveling 2.54 mi. road from Sparks to Vista, Route 1, Sect. B4, Washee Co. S. C. Durkee, state engr.

New Hampshire—Aug. 21, by State Hy. Comn., Concord, graveling 3.15 mi. Main St., Litchfield, Hillsborough Co., 21 ft. $35,000. W. N. Prescott, Concord, engr.

New Jersey—Aug. 26, by Bd. Freeholders Bergen Co., Court House, Hackensack, constructing 4.04 mi. State Highway Route 4, (1927) Sect. 4, Arcola to Hackensack River, R. P. McClave, co. engr.; adv. E. N.-R. July 14.

N. J., Mahwah—Aug. 28, by Hohokus Twp. Comn., Town Hall, grading, 8 in. curbing, both sides Franklin Turnpike from Ramsay Boro to New York State line. M. Davidson, Ramsay, engr.

N. J., Long Branch—Aug. 19, by Bd. City Comrs., asphalting between brick shoulders 2nd Ave., from Franklin Ave. and West End Court. O. R. Seamon, 210 Bway., city engr.; adv. E. N.-R. Aug. 14.

N. J., Newton—Aug. 26, by Bd. Freeholders Sussex Co., graveling 10,053 sq.yd. Morris Lake Rd., Sect. 2, Twp. Sparta; 15,000 cu.yd. Colesville New York State Line Rd., Sect. 2, Wantage Twp.—and concrete paving 2,520 sq.yd. Munson Corner State Hy. Rd., Franklin Boro. H. Snook, co. engr.; adv. E. N.-R. Aug. 14.

N. J., Verona—Aug. 19, by Boro Council, Boro Hall, rein.-con. or bituminous concrete on concrete paving Claremont Ave. $25,000. Miller & McGiffert, 484 Bloomfield Ave., Montclair, engrs.

New York—Sept. 4, by A. W. Brandt, comr. Hys., Albany, constructing highways in Columbia, Delaware, Lewis, Montgomery, Otsego, Rensselaer, and Yates Counties; reconstructing roads in Clinton, Essex, Herkimer, Oneida, and Otsego Counties; adv. E. N.-R. Aug. 14.

N. Y., Buffalo—Aug. 21, by G. Fisk, comr. P. Wks., Municipal Bldg., paving Clark, Lombard and Exchange Sts., W. Rathman, city engr.

N. Y., New York—Aug. 15, by J. Miller, pres. Manhattan Boro, Municipal Bldg., 4 in. granite block on concrete paving 16th St.; sheet asphalt on concrete paving 114th St.

N. Y., North Castle—Aug. 22, by C. MacDonald, ch. engr., Court House, White Plains, rein.-con. paving 0.73 mi. North Greenwich Rd., Co. Rd. 105, for Westchester Co.; adv. E. N.-R. Aug. 14.

N. Y., Peekskill—Aug. 22, by C. MacDonald, co. engr., Court House, White Plains, curbing, rein.-con., sheet concrete, asphalt block and warrenite bitulithic paving 1.63 mi. Welcher Ave. and Washington St., for Westchester Co., White Plains; adv. E. N.-R. Aug. 14.

N. Y., St. George—Aug. 20, by J. A. Lynch, pres. Richmond Boro, Boro Hall, bituminous macadam paving Westcott Blvd. and Holland Aves.; concrete paving Arthur Kill Rd., and placing cinders on Kingdom Ave.

Oklahoma—Aug. 18 by State Hy. Dpt., Oklahoma City, grading, drainage 121.27 mi. hys. in Beaver, Texas, Cimarron, Osage Counties. $287,000. A. R. Losh, Oklahoma City engr.

Okla., Tulsa—Aug. 19, by E. E. Logan, city aud., grading, asphalt paving 720 ft. Boston Ave. Elevated Street. $168,908. V. H. Cochran, Wright Bldg., engr.

Pa., Greenburg—Aug. 18, by H. Wirshing, city clk., City Hall, grading, curbing, paving Lemington Ave., Turney St., and alleys. F. E. Maddocks, city engr.

Pa., Johnstown—G. W. Griffith, supt. Streets & P. Impvts., soon takes new bids curbing, gutting, rein.-con. paving 11,037 sq.yd. Conemaugh St. and Hillside Blvd. Former contract rescinded. Noted Aug. 7.

Pa., Phila. — Aug. 19, by Dpt. P. Wks., Bureau of Hys., graveling Schedule A—asphalt paving Schedule B — smooth dressed granite block repaving Schedule C—improving country road, Schedule D — improving Holme Ave., Schedule E—cast iron bases for street signs, Schedule F—steel for Hunting Park Ave. Bridge, Schedule G.

Pa., Waynesburg—Aug. 28, by K. W. Scott, secy., Municipal Bldg., grading, curbing, brick paving 1,360 ft., East Lincoln St., 30 ft. G. D. Jenkins, Municipal Bldg., engr.

R. I., East Providence (br. Providence)—Aug. 15, by Town Council, Town Hall, grading 2,050 cu.yd., graveling 1,350 cu.yd. and seal coat surfacing 7,500 sq.yd. Bishop Ave.

Tennessee—Aug. 29 by Dpt. Hys. and P. Wks., Nashville **(F.A.P. means Federal Aid Project and S.A.P. State Aid Project)** grading, culverts 2.5 mi. S.A.P. 166-D, Trousdale Co.—7 mi. S.A.P. 179-E, Blount Co.—5 mi. S.A.P. 195-D, Henderson Co.—6 mi. S.A.P. 346-C, Montgomery Co.—3.5 mi. S.A.P. 553-A and S.A.P. 20, Sumner Co. grading culverts, bridging 4 mi. S.A.P. 308-D, Montgomery Co. 6 mi. S.A.P. 384-B, Van Buren Co.—10.5 mi. S.A.P. 544-B, Hamilton-Meigs Counties—7 mi. S.A.P. 553-B, Sumner Co.—concrete and steel bridge on F.A.P. 85-B Roane Co. R. H. Baker, comr.

Tenn., Cookeville—Aug. 20, by City Clerk, grading, curbing, concrete paving 20,200 sq.yd. Broad St. $50,000. V. V. Long & Co., Colcord Bldg., Oklahoma City, Okla., engrs.

Tex., Memphis—Sept. 1, by A. C. Hoffman, judge, Hall Co. Court, grading, bridging 5.783 mi., Job 45, Unit 1, Sect. 3, 26 ft. Haste Engineering Co., Inc., Memphis, co. engrs.

Virginia—See "Contracts Awarded."

Virginia — Aug. 26, by State Hy. Comn., Richmond, concrete paving 3.4 mi. hy. Elizabeth City Co.—2 mi. Warwick Co.—macadam or gravel surfacing 10 mi. Princess Anne Co.—bituminous surfacing 6.8 mi. Pulaski Co. — bridge over Rivanna River, Fluvanna Co. Est. $250,000.

West Virginia — Aug. 26, by State Road Comn., Charleston, grading, widening, fill, concrete, and bituminous paving 59.1 mi. hys., Fayette, Raleigh, Kanawha, Marshall, Monroe, Pocahontas, Roane, Tyler, Wetzel, Wood and Pleasants Counties; 130,000 ft. wire rope guard rail for hys., Kanawha, Wood, Wirt and Jackson Counties. E. D. Yewell, Box 1356, Charleston, engr.

CONTRACTS AWARDED

Arizona—State Hy. Comn., Phoenix, grading, 4 mi. road from Fredonia to State Line to Hodgeman & MacVicar, 714 Plymouth Rd., Pasadena, Calif., $34,563. Noted July 10.

Ark., Booneville—Bd. City Comrs., grading, paving Main St. Bway. to Dick Co., Oklahoma City, Okla., $80,685. Noted July 10.

Ark., Pine Bluff—City, paving 17th St. to Fry Bros., Iola, $39,443.

California — State Hy. Comn., Sacramento, concrete paving 1.68 mi. Placer Co., to N. M. Ball, Porterville, $62,253—untreated crushed gravel or stone surfacing 1.98 mi., also bridges in Mendocino Co., to E. C. Coats, Sacramento, $83,289—oil treated crushed gravel or stone pving 16.19 mi. Riverside Co., to B. Noble, San Diego, $256,610—9.5 mi. San Bernardino Co., to H. W. Rohl, 727 West 7th St., Los Angeles, $187,326. Grand total $591,478.

California—State Hy. Comn., Sacramento, bituminous macadam paving 1.3 mi. Marin Co., to Granfield, Farrar & Carlin, 67 Hoff St., San Francisco, $54,415; concrete paving 3 mi. San Luis Obispo Co., to Cornwall Constr. Co., Santa Barbara, $130,829.

Calif., Palo Alto—For 2 in. asphaltic concrete on 6 in. concrete paving California Ave., to W. A. Dontanville, Salinas, $53,464.

Calif., San Bruno — City Council, grading, asphalt on waterbound macadam paving streets in 5th Addition, to Hanrahan Co., Standard Oil Bldg., San Francisco, $43,009. Est. to exceed $30,000. Noted July 24.

Calif., San Rafael — City Council, grading, concrete paving 10,000 sq.ft. Palm Street Impvt. Dist., to S. McGaw, Box 387, $33,510. Noted July 31.

Streets and Roads (Continued)

Ill., Belleville—St. Clair Co., concrete paving 5.28 mi. road between Millstadt and East St. Louis and 4.97 mi. between Freeburg and Fayetteville, to Stocker Gravel & Constr. Co., Highland, Ill., $90,407 and $82,246 respectively—0.5 mi. on Freeburg-Fayetteville Rd., to A. R. Hursey Constr. Co., 1716 North 25th St., East St. Louis, Ill., $20,098—0.5 mi. McClintock St., Belleville, to Hoeffken Bros. Constr. Co., 222 West B St., Belleville, $19,511—and culverts over creek in Signal Hill Dist. to C. Hurley, East St. Louis, Ill., $19,181. Grand total $231,443.

Ill., Chicago—Bd. Comrs., Cook Co., County Bldg., to J. Mackler & Co., Chicago Heights, improving 26th St., $44,981—to Pronger Bros., Blue Island, Kedzie Ave., $41,126; Ashland Ave., $12,198—to Bway. Constr. Co., Wacker Drive, Gunnison St., $14,086—to Municipal Paving Co., Oak Park, Gunnison St., $16,706—to W. A. Black Co., 165 West Wacker Dr., Southwest Highway, $48,004—to Acme Eng. & Constr. Co., Chicago, Dixie Hy., $41,389—to States Impvt. Co., 160 North LaSalle St., 95th St., $77,448—to Arcole Constr. Co., Evanston, Busse Hy., $38,087; Oakton St., $33,564, and Oakton St., $13,507. Grand total $381,096. Noted July 24.

Ill., Lyons — City, concrete paving 36,950 sq.yd. concrete paving to P. J. Crowley, 12 North 5th Ave., Maywood, $176,320—8,720 sq.yd. paving to W. T. Ryan, LaGrange, $39,142.

Ill., River Grove—Bd. Local Impvts., to H. G. Goelitz Co., Oak Park, grading, curbing, rein.-con. paving River Grove Ave., $83,122; Marwood St., $8,911—to G. D. Hardin, 3139 Indiana Ave., Chicago, sewers in Marwood Ave., $234; Forest View Ave., $1,815; lead pipe water service Forest View Ave., $2,607, and in Marwood St., $333. Grand total $97,022. Noted July 17.

Indiana — State Hy. Comn., Indianapolis, paving 2.703 mi. State Rd. 66, Spencer Co., to R. E. Hanson, Terre Haute, $39,574; 0.814 mi. State Rds. 31 and 56, Scott Co., to Sherrill-Blackwell Constr. Co., Bedford, $28,462. Noted June 12.

Ind., Covington—Comrs. Fountain Co., rock asphalt paving Jackson Rd., to W. A. Allen, Hillsboro, $53,309. Est. $86,143. Noted July 17.

Ind., Hartford City — Comrs. Blackford Co. concrete paving 14,766 ft. West Franklin St., to W. J. Ness & Co., Mishawaka, $57,433. Noted July 17.

Ind., Lafayette—Comrs. Tippecanoe Co., concrete paving 2.34 mi. L. V. Snideman Rd., to F. Vester, Lafayette, $54,000. Noted July 10.

Ind., South Bend—St. Joseph Co., constructing A. G. Newcomer Drain, to F. M. Horton, 53 West Jackson Blvd., Chicago, Ill., $24,476.

Ind., Valparaiso—Comrs. Porter Co. concrete paving 2.86 mi. Walter Erickson Rd. and 1.26 mi. John Pearson Rd., to Gast Constr. Co., Warsaw, $60,900 and $26,700 respectively. Noted July 17.

Ia., Centerville—For 5.595 ft. concrete integral curbing, 6 storm water inlets, 50 ft. 18 in. vitr. pipe, 7 in. rein.-con. paving 8,278 sq.yd. Drake Ave., to F. F. Weir Constr. Co., Moline, Ill., $23,453. Noted July 17.

Ia., Le Mars—Plymouth Co. graveling 10 mi. Perry Creek Rd., to Evanson Constr. Co., Earley, $16,000; grading 4 mi. by Milnerville, to George W. Condon Co., 223 Grain Exchange Bldg., Omaha, Neb., $12,000; bridges, to Christiansen Bros., Minneapolis, Minn., $9,510.

Ia., Newton—Jasper Co., graveling secondary road system, to L. W. Hayes, Bethany, Mo., $27,664.

Ia., Monticello—R. Echkernacht, city clk., 7 in. rein.-con. paving 22,000 sq.yd., to Korneman Bros., Muscatine, $40,426. Noted July 17.

Ia., Waverly—Bremer Co. graveling 15,585 yds. trunk roads to Beu & Sons, Sumner, $11,529.

Kansas—State Hy. Dpt., to A. L. Cook, Ottawa, grading 0.811 mi. Barton Co., $5,521; 1.996 mi. Barton Co., $19,577; 0.361 mi. Harper Co., $2,946—to M. W. Waston, Mulvane Bldg., Topeka, 7.575 mi. Comanache Co., $7,636—to Charles Hume, Great Bend, 10.928 mi. Barton Co., $10,819—to E. Graff, Newton, grading, bridging 4.319 mi. Cowley Co., $32,972—to R. Samford, Caldwell, 4.837 mi. Harvey Co., $25,346, 1.554 mi. Harvey Co., $6,888—to Cook & Cone, Ottawa, 10.592 mi. Harvey Co. $17,251; to Yancey Constr. Co., Abilene, O. 0.23 mi. Kingman Co., $9,211—to J. W. Gaston, Larned, bridge in Barton Co., $3,313; Barton Co., $1,524; grading, bridging 3.289 mi. Cowley Co., $57,839—to Gray & Marbut, Burlington, bridge in Cowley Co., $30,047—to Vaughn Stuart, Dodge City, Harvey Co., $14,917—Grand total $230,891.

Kan., Kansas City—City, paving Ilathe Blvd. and 8th St. to T. P. Thompson, 3908 Forrest Ave., $24,088 and $57,652 respectively.

Kentucky — State Hy. Dpt., Frankfort, rock asphalt surfacing 4.8 mi., Fleming Co., to Billiter, Miller & McLure Covington, $113,515—grading 5.6 mi., Monroe Co., to S. Pace, Burkesville, $52,806—traffic bound limestone surfacing 7.3 mi., Nelson Co., to H. F. Mathis, Bardstown, $33,580—rein.-con. paving 8.9 mi. Pikeville-Prestonsburg Rd. and 6.5 mi. Pikeville-Whitesburg Rd., Pike Co. to Carey-Reed Co., Lexington, $193,739 and $142,210 respectively—rein.-con. deck girder span bridge, over Green River, 1 mi. east of Liberty, Casey Co. to Price Constr. Co., Huntington, W. Va., $34,972. Grand total $570,822. Noted July 10.

La., New Orleans—Concrete paving 3,380 sq. yd. Freret St., to Craven & Lang, New Orleans, $39,370—5,500 sq.yd., 6,220 sq.yd. North Galney St., to South Uvalde Co., New Orleans, $27,960 and $39,820 respectively—dead reef shell surfacing 6,880 cu.yd. Memphis St., to Globe Constr. Co., New Orleans, $27,510. Grand total $134,660.

Maryland — State Roads Comn., Baltimore, concrete shoulders, 3.8 mi. Baltimore Co., to Harry T. Campbell & Sons Co., Towson, $46,241—3.63 mi. Cecil Co., and 3.97 mi. Baltimore Co. to G. & L. Contg. Co., Maple Ave., Overlea, Baltimore, $22,256 and $20,886 respectively—graveling 7.63 mi., Prince George's Co. to W. C. Briddell Co., Drovers & Mechanics Bldg., Baltimore, $60,150—hot or cold bituminous mix, resurfacing 2.08 mi. Howard Co., to Thomas Bennett & Hunter, Westchester, $19,631—1.56 mi. Anne Arundel Co., to P. Flanigan & Sons, Harford Rd. and B. & O. R.R., Baltimore, $13,503. Grand total $182,667. Noted July 31.

Maryland — State Roads Comn., Baltimore, amiesite paving 1.3 mi. Montgomery Co., to Cranford Co., 3056 K St., N. W., Wash., D. C., $10,675. Noted July 3.

Maryland—State Roads Comn., Baltimore, hot or cold bituminous mixture resurfacing 2.37 mi. Anne Arundel Co., to Baltimore Asphalt Block & Tile Co., 1320 Monroe St., Baltimore, $19,680. Noted July 24.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt paving Lamartine St., Ward 19, to Dooley Bros., Inc., 73 Howard St., Roxbury. Est. $25,000. Noted July 24.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt paving Townsend St., Wards 11 and 12, to A. Singarella, 24 Tremlett St., Dorchester, $28,171. Noted July 24.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., sheet asphalt paving Centre St., to A. R. Doyle, Inc., 44 Perkins St., Jamaica Plain. Est. $25,000. Noted July 24.

Mass., Franklin — Bd. Selectmen, repairing streets, day labor. To exceed $25,000.

Mass., Marlboro — Street Dpt., J. F. Granger, supt., vulcanized sheet asphalt paving Main St., to Simpson Bros. Inc., 77 Summer St., Boston, at $1.75 per yd. Noted July 24.

Michigan — C. L. Cowgill, resident engr., Plymouth, concrete paving 11.041 mi. Rd. F081-22, Contr. 2, 20 ft., Washtenaw Co., to Grace Constr. Co., Marshall, for State Hy. Comn., Lansing, $197,407. Noted July 31.

Michigan — R. W. Roberts, resident engr., Saginaw, concrete paving 2.524 mi. Rd. F025-21, Contr. 2, 40 ft., Genesee Co., to M. W. Cochran, Dearborn, for State Hy. Comn., Lansing, $92,244. Noted July 31.

Mich., Detroit—H. W. Busch, comr. Parks and Boulevards, 8 in. concrete paving 29,860 sq.yd. in River Rouge Park Rd., to Bishop & Weir, 6451 Six Mile Rd. East, $53,538. Noted July 24.

Miss., Kosciusko—Comrs. Attala Co., graveling 59 mi. roads to Concrete Gravel Co., Hattiesburg, at $1.151 per ton—hauling gravel for same, to Hester & Sanders, Sallis and Allen & Rainey, Kosciusko, $0.344 per cu.yd. Noted July 31.

Miss., West Point — Curbing, guttering, asphalt paving 6,078 ft. 4 streets, to Anderson-Brandon & Son, Aberdeen, $47,358.

Mont., Miles City—City Clk., grading, curbing, guttering, paving to Narson-Erling Co., Sioux Falls, S. D., $189,006. Noted July 24.

Nevada — State Hy. Comn., Carson City, grading, graveling 23.22 m.i Three Mile-North Wells Co., to Thousand Springs Creek, Route 13, Sect. C2, Elko Co., to Utah Constr. Co., Ogden, Utah, $117,684.

New Hampshire—State Hy. Comn., Concord, 3 in. on 5 in. gravel surfacing 13,830 cu.yd. hy. in Candia and Hooksett, to Dracut Constr. Co., Dracut, Mass., $47,576 engrs., est. $83,000. Noted July 24.

New Hampshire—State Hy. Comn., Concord, 6 in. rein.-con. on 8 in. gravel paving 12,943 sq.yd. Grafton Co. and 56,112 sq.yd. Carroll Co., to Lane Constr. Corp., 134 State St., Meriden, Conn., $32,898 and $158,267 respectively, est. $37,000 and $215,000 respectively. Noted July 24.

N. J., Morristown—Bd. Freeholders Morris Co., Court House, reconstructing road from Madison to Florham Park to Franklin Constr. Co., 20 Washington Pl., Newark, $61,876. Noted July 10.

N. J., New Brunswick — Bd. Freeholders Middlesex Co., County Record Bldg., paving Main St., Sayreville, to C. Sebolt, New Brunswick, $92,243—penetration macadam paving Woodbridge-New Brunswick Turnpike to Utility Constr. Co., 5 Spring St., $37,410—Aqueduct-South River Rd., to F. Gloff, $7,376—and Keasby Rd. to United Constr. & Supply Co., New Brunswick, $6,992. Grand total $144,021. Noted July 24.

N. J., North Plainfield — Mayor and Boro Council, paving Watchung Ave. to Wallace & Gilbert, Ocean City, $85,929.

N. J., Oakhurst—Ocean Twp. Com., concrete road from Monmouth Rd. to Neptune Hy. to Jannarone Constr. Co., Belleville, $58,046. Noted July 24.

New York — A. W. Brandt, comr. Hys., Albany, concrete paving 5.83 mi. Orange Co. to Hempstead Paving Co., Inc., Hempstead $325,897 est. $491,517—4.6 mi. Columbia Co. to Menquale & Oneglia, Stockbridge, Mass., $212,399 est. $292,474—2.6 mi. Rockland Co. to G. DiNapoli, Inc., 80 Main St., Hackensack, N. J., $156,810 est. $217,250—0.24 mi. Columbia Co. to Caruso Constr. Co., Albany, $9,278 est. $11,100. Grand total $704,384. Noted June 19 and July 10.

N. Y., Brooklyn—H. Hesterberg, pres. Brooklyn Boro, Boro Hall, grading Autumn Ave. to Grimm Contg. Co., 170 McKinley Ave., $1,894—bituminous macadam paving Bay 49th St. to M. J. O'Hara Contg. Co., Neptune Ave. and West 19th St., $30,141—asphalt paving Blake Ave. to Brooklyn Alcatraz Asphalt Paving Co., 407 Hamilton Ave., $5,851 and $4,403 respectively—Central and Meserole Aves. to Carbloc Paving Co., Stagg St., $7,569 and $22,067 respectively—East 53rd and East 93rd Sts. to B. Turecamo Contg. Co., New Cropsey Lane, $6,878 and $8,557 respectively—15th St. to Cranford Co., 52 9th St., $10,236—granite block paving 15th St., to Columbia Contg. Co., 26 Day Court, $71,845. Grand total $169,541. Noted July 17.

N. Y., Brooklyn—H. Hesterberg, pres. Brooklyn Boro, Boro Hall, bituminous concrete paving East 95th St. to Brooklyn Alcatraz Co., 407 Hamilton Ave., $25,600—grading 74th St. to Flood Eng. Corp., 186 Remsen St., $4,180. Noted July 24.

N. Y., New York—W. J. Flynn, acting pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., sheet asphalt paving Mosholu and Longfellow Aves. to Clay Contg. & Bldg. Co., 368 East 167th St., $55,143 and $8,502 respectively—granite block paving Paltsade Ave. to Burnside Contg. Co., 1339 Oak Point Ave., $9,837—grading Moran Ave. and East 215th St. to Gramaglia Bros., 5037 Fieldstone Rd., $10,723 and $15,316 respectively—grading Eastern Blvd. to F. Del Baso & Son, 1933 West Farms Rd., $28,796. Grand total $128,317. Noted July 24.

N. Y., New York—J. Miller, pres. Manhattan Boro, Municipal Bldg., asphalt block paving West 185th St., to S. D. Nugent, 1380 Merriam Ave., $19,456; grading 154th St. to A. J. O'Brien, Inc., 17 West 42nd St., $10,704 and granite block paving 17th St., to E. T. Barry, Laurelton, $20,005. Grand total $50,166. Noted July 31.

N. Y., New York—J. Miller, pres., Manhattan Boro, Municipal Bldg., granite block on concrete repaving Marginal St. to Regan Towers Co., 124 West 121st St., $228,018. Noted July 31.

N. Y., St. George—J. A. Lynch, pres. Richmond Boro, Boro Hall, curbing Cromwell Ave. to St. Leger & D'Aquila, $12,673 — grading Richmond Rd. to Vanbro Constr. Co., 24 Elizabeth St., Port Richmond, $10,315 and macadam paving to C. M. Bristow, $3,700. Grand total $26,689. Noted July 17.

N. Y., St. George—J. A. Lynch, pres. Richmond Boro, Boro Hall, bituminous concrete paving Amboy Rd. to Vanbro Constr. Co., 24 Elizabeth St., Port Richmond, $36,030; Merseau Ave. to J. E. Donovan, 2205 Richmond Terrace, Port Richmond, $20,418. Noted July 24.

Ohio—R. N. Waid, dir. hys., Columbus, widening with concrete, curbing and guttering, 0.31 mi. Jefferson Co., to E. A. Hutcher, Mingo Junction, $4,901—grading, culverts, 2.575 mi. Belmont Co., to Horkner Co., 1445 East 49th St., Cleveland, $61,810 — bitulithic concrete paving 4.02 mi. Butler Co., to Federal Asphalt Paving Co., Hamilton, $31,759—brick paving 2,150 furnishing and delivering brick Adams Co., to Frowine Bros., Portsmouth, $116,724—0.44 mi. Carroll Co., to T. A. Keeley Co., Dover, $24,237—2,513 mi. Cuyahoga Co., to Rochl Bros. Paving & Constr. Co., 7000 Dennison Ave., Cleveland, $337,947—3.536 mi. Sect. "B" Cleveland-Rittman Rd., Cuyahoga Co., to Highway Constr. Co., Builders. Exch. Bldg., Cleveland, $356,133—rein.-con. paving 2.902 mi. Belmont Co., to Lewis & Copeland Constr. Co., Lima, $116,299—0.395 mi. Mercer Co., to W. C. Iliff, Cedarville, $57,273 — concrete paving 4.3533 mi. Hamilton Co., to Bigler Paving Co., Middletown, $123,923—1.175 mi. Morrow Co., to Van Wagner Constr. Co., Bowling Green, $101,031—slag resurfacing 4.66 mi. Guernsey Co., to Hall & Barker, Cambridge, $11,424 — waterbound macadam paving 2.367 mi. Clinton Co., to D. W. Botkin & Son, 767 South 22nd St., Columbus, $52,069—sheet asphalt on brick resurfacing 0.955 mi. Union Co., to B. F. Patterson, 4476 North High St., Columbus, $21,641—removing portion of landslide and placing steel and concrete piling 0.056 mi. Morgan Co., to Champion Drilling Co., Wellston, $11,693. Grand total $1,528,864. Rejected bids July 29, grading, concrete paving 4.139 mi. by, Lawrence Co., engrs. est. $200,874—concrete curbing, rein.-con. paving 0.799 mi. Belmont Co., engrs. est. $34,752—rein.-con. or brick paving 2.049 mi. Jefferson Co., engrs. est. $203,670 rein.-con. $175,039 — concrete beam bridge, Lawence Co., engrs. est. $27,028—steel truss bridge, Marion Co., engrs. est. $59,442—Ottawa Co., engrs. est. $59,006, also concrete beam bridge, same co., engrs. est. $18,406.

O., Akron—F. E. Swineford, dir. P. Serv., grading, curbing, walks, vitr. brick paving 13,950 sq.yd. Glenwood Ave., to P. Maline, 52 Hoover St., $63,000.

O., Canton—Stone curbing, 4 in. brick on concrete paving Cleveland Ave., S. W., to Garaux Bros. Co., 415 9th St., S. W., $89,071.

O., Cleveland—Comrs. Cleveland Co., repairing curb, incl. 95,400 lbs. reinforcing steel, 4,400 ft. well casing, 1,600 ft. mastic filler, South Kinsman Rd., to Walter Bros. Contr. Co., Warrensville Heights, $19,272. Est. $25,360.

O., Columbus—W. H. Duffy, director of service, grading, curbing, water service, sewers, asphalt paving Guilford, Oakley Aves., and Walhalla Dr., to B. F. Patterson, 4476 North High St., $28,251; asphalt paving Woodland Ave., to A. W. Burns, 424 Woodland Ave., $15,808. Noted July 24.

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Streets and Roads (Continued)

O., Dayton—Rein.-con. paving Illinois and St. Paul Aves., to Finke Engineering Co., 125 North Main St., $19,521 and $35,879 respectively; Harvard Blvd. to H. Long, 349 Cornell Dr., $7,386. Grand total $62,786.

O., Elyria—Comrs. Lorain Co., F. E. Ellenberger, clk., grading, bituminous macadam paving Lorain-Avon Rd., $58,000. Owner builds. Noted June 12.

O., Portsmouth—Comrs. Scioto Co., widening, waterbound macadam paving 3½ mi. Narrows Rd., 18 ft., to Sammons & Queen, Louisa, Ky., $26,618.

O., Youngstown—Bd. Control, velo brick and brick paving, 2,800 ft. Mahoning Ave., 34 ft. to J. Kane Constr. Co., Youngstown, $69,724. Est. $100,000.

Okla., Chickasha—Grading, paving 10 blocks 16th St., 30 ft., to W. E. Edmiston, Chichasha, $34,697.

Okla., Tulsa—City Comn., grading, curbing, sheet asphalt paving 4,391 sq.yd. Street Imp. Dist. 1042, to H. L. Cannady Co., 1116 South Lewis St., $37,692; grading, curbing, paving 10,421 sq.yd. in Street Imp. Dist. 1050, to Calumet Constr. Co., 229 North Nogales St., $44,335. Noted July 24.

Okla., Woodward—Grading, paving 10 blocks 7th St., to L. S. Fisher, Woodward, $43,697.

Pennsylvania—State Hy. Dpt., Harrisburg, rein.-con. paving 16,091 ft. Greene Co. to Prati & Moore, Inc., Hollidaysburg, $186,269—1,735 ft. Cambria Co. to Windber Constr. Co., Windber, $28,024. Noted Aug. 7.

Pennsylvania—State Hy. Dpt., rein.-con. paving 2,330 ft. Route 35, Carlisle Boro and South Middleton Twp. to P. R. Hastetter, Co., Inc., York, $23,735.

Pennsylvania—State Hy. Comn., Harrisburg, vitrified brick on concrete paving 11,148 ft. Route 120 Sect. 5, Braddock Twp., Allegheny Co. to McCreedy Constr. Co., Braddock, $302,222. Noted July 10.

Pa., Bradford — Grading, curbing, guttering, vitrified brick on concrete paving East Main and West Washington Sts. to F. Ross, Bradford, $51,605. Noted July 17.

Pa., Bradford — Curbing, grading, paving Congress and Boylston St., Sect. 1, to T. J. Halloran, Elmira, N. Y., and Kennedy St. and South Ave., Sect. 2, Hastings Paving Co., 25 Broad St., New York.

Pa., Columbia — Caldwell Parish, constructing 11 mi. hy., to J. W. McKethen, Grayson, $32,236.

Pa., Pittsburgh—Dir. P. Wks., malleable iron and steel fences on Viaduct 2, Blvd. of Allies and Grandview Ave., to Fort Pitt Malleable Iron Co., McKees Rocks, $39,969 and $15,989—rein.-con., curbing to Welsh Constr. Co., 2331 Los Angeles Ave., $3,680. Grand total $59,638.

Tennessee—State Dpt. Hys., Nashville, paving 3.188 mi. hy. Shelby Co., to Ziegler Constr. Co., American Trust Bldg., Nashville, $11,180—grading, culverts, 4.24 mi. Robertson Co., to R. F. Pryor & Co., Mayfield, Ky., $22,388—12.68 mi. Cocke Co., to N. L. Teer, Durham, N. C., $179,658—10.043 mi. Coffee Co., to Municipal Paving & Constr. Co., Cotton States Bldg., Nashville, $46,659—6.641 mi. Davidson Co., to R. E. Martin, Cotton States Bldg., Nashville, $72,941 — 12.095 mi. Chester Co., to Gregory Chandler Co., Virgilina, Va., $125,060—concrete bridge and approaches, over Cane Creek, Hickman Co., to Fite Constr. Co., Dickson, $51,720 — 3 bridges over 20 ft. span Chester Co., to Frazier & Cocke, Wickliffe, Ky., $90,551. Grand total $700,157. Noted July 24.

Tenn., Memphis—Sheet asphalt paving Main St. from Calhoun to Iowa Sts., to Carey & Reed, Lexington, Ky., $45,759.

Tenn., Shelbyville — Grading, concrete and rock asphalt on concrete paving Public Square, North Main St. and Belmont Blvd., to Municipal Paving & Constr. Co., Cotton States Bldg., Nashville, $99,853.

Tenn., Springfield—J. R. Adams, city clk., grading, curbing, guttering, paving 15,000 sq.yd. Districts 22, 24, 25, 26, 27, 28 and 29, to Eller & Olsen, Cotton States Bldg., Nashville, $39,164, est. $41,000.

Texas—G. Gilchrist, state hy. engr., Austin, (e.e. means Engineers Estimate), grading, culverts 12.453 mi. hy. Leon Co., to J. C. Kelly, Trinity, $97,492, e.e. $110,000—20.982 mi., Wilbarger Co., to R. B. Stroup, Red Oak, $73,875, e.e. $88,000—14.763 mi., Victoria Co., and 14.366 mi., Haskell Co., to Word & Worrell, Itasca, $50,987 and $47,623 respectively, e.e. $54,000 and $66,000 respectively—12.321 mi., Lubbock Co., to Field Bros. & McCelvey, 308 Mackey Bldg., Lubbock, $24,989, e.e. $34,000—6.073 mi., Caldwell Co., to Standifer Bros., Big Wells, $65,397, e.e. $138,000—11.486 mi., Aransas Co., to F. P. McElwrath, Box 727, Corsicana, $44,575, e.e. $56,000—11.567 mi., Hopkins Co., to J. T. Ables, Modell, Okla., $63,869, e.e. $60,000—5.948 mi., Dallas Co., to J. F. Buckner, 407 North Main St., Cleburne, $67,611, e.e. $54,000 — 12.7 mi. Knox Co., to Huddleston & Work, Crosbyton, $59,758, e.e. $70,000—9.522 mi., Navarro Co., to E. R. Leach, Thornton, $33,629 e.e. $26,000—17.058 mi., Galveston Co., to T. L. James & Co., Ruston, La., $129,288, e.e. $86,000 — 12.253 mi., Leon Co., to Gunter & Parrott, Kasse, $58,037, e.e. $70,000 — 16.106 mi., Lubbock Co., to W. S. Thompson Constr. Co., San Angelo, $29,835, e.e. $48,000—11.129 mi., San Jacinto Co., to W. E. Lee, West Point, $57,485, e.e. $68,000—14.691 mi. McLennan Co., to McCall Engineering Co., 307 Amicable Bldg., Waco, $72,738, e.e. $78,000—13.834 mi., Haskell Co. and 9.021 mi., Tarrant Co., to Womack, Hemming & Rollins, Sherman, $39,120 and $72,225 respectively, e.e. $56,000 and $100,000 respectively—7.536 mi., Ellis Co., to J. S. Moore & Sons, Lufkin, $32,707, e.e. $40,000, all foregoing 26 ft.—concrete paving 13.455 mi. Childress Co., 18 ft., to Stuckey Constr. Co., Box 1445, Wichita Falls, $280,827, e.e. $300,000—8.955 ft. Navarro Co., 20 ft. to J. S. Clements, Shreveport, La., $193,273, e.e. $220,000—grading, concrete paving 1.338 mi., Harris Co., to Russ Mitchell Inc., 710 Petroleum Bldg., Houston, $57,073, e.e. $64,000 — double bituminous surfacing 10 mi., Burnet Co., to Brown & Root, Box 745, Austin, $23,180, e.e. $25,000—concrete or bituminous filled brick on concrete paving 7.736 mi., Tarrant Co., to General Constr. Co., 414 Capps Bldg., Fort Worth, $182,108, e.e. $240,000—grading, triple bituminous surfacing 7.67 mi. Ector Co., to Cocke & Braden, Marshall, $81,909, e.e. $100,000 all foregoing 18 ft. Grand total $1,939,610. Noted July 24.

Tex., Houston—Comrs. Harris Co., grading, bridging, concrete widening 0.77 mi. La Porte Rd., to B. P. Panas & Co., 406 Esperson Bldg., $27,016.

Tex., Houston—Harris Co., grading concrete paving, 3.7 mi. Wallisville and Oats Rds., 20 ft. to Russ Mitchell Inc., 701 Petroleum Bldg., $115,022. Noted July 21.

Virginia—State Hy. Dpt., Richmond, soiling 4.803 mi. hy. Fluvanna Co., to C. A. Ragland, Louisburg, N. C., $56,448. Rejected bids grading 10 mi. hy. Princess Anne Co. Noted July 24 and 10 respectively.

Virginia—State Hy. Comn., Richmond, clearing, grubbing, grading, drainage structures, one course macadam surfacing 9.998 mi. Princess Anne and Norfolk Counties, to Brooks Constr. Co., Inc., Norfolk, $161,963—grading, drainage structures, one course macadam surfacing 4.148 mi. Giles Co., to M. T. McArthur, Johnson City, Tenn., $70,986—clearing, grubbing, grading, drainage structures, topsoiling 11.7 mi. Buckingham and Appomattox Counties, to N. L. Teer, Durham, N. C., $73,065—clearing, grubbing, drainage structures 7.293 mi. Highland Co., to J. J. Battershill & Son, Virgilina, $125,741—9.595 mi. Westmoreland and Northumberland Counties, to Perkins & Barnes Constr. Co., Blackstone, $44,608—steel span bridge over Potomac Run River, Stafford Co., to J. S. Bowers, Whiteville, N. C., $10,852. Grand total $487,215.

Wash., Seattle—King Co., grading 2 mi. Renton-Three Tree Point Road to Harrison Bros., Tacoma, $31,725. Noted July 24.

West Virginia—State Hy. Comn., Charleston, bituminous macadam, modified bituminous treated surfacing 6 mi. hy. Boone Co., to R. B. Tyler Co., Louisville, Ky.—concrete surfacing 13 mi. hy. Cabell Co., and widening, concrete surfacing 1.8 mi. hy. Jefferson Co., to W. A. Wilson & Sons, St. Marys, $379,956 and $26,841 respectively—widening, retread surfacing 2.7 mi. hy. Jefferson Co., to Murphy Constr. Co., Morgantown, $35,804—retread surfacing 2.7 mi. hy. Kanawha Co., to Mason & Bartlett, Clarksburg, $24,515—grading 3 mi. Putnam Co., to Pinnell & Pfost, Ripley, $52,121—graveling 8 mi. Wetzel Co., to Bartlett Constr. Co., Clarksburg, $55,947—special rock fill, on Project 3434 Logan Co., to Hunt-Forbes Constr. Co., Huntington, $10,680—bridges on hy. Grant Co., to W. B. Courtney & Co., Salem, $6,737 — Raleigh Co., to Dennison & Ritter, Bristol, Va., $2,232—Ritchie Co., to Copley & Cooper, Harrisville, $8,687—Tyler Co., to Nelson & Copley, Madison, $15,926—culvert fill on Project 2180, Wayne Co., to Hope Constr. Co., Louisa, Ky., $34,247—wire rope guard rail, on hys. in Doddridge, Harrison and Taylor Counties, to H. C. Parrish, Spencer, $5,268—storm sewers in Hancock Co., to Weirton Constr. Co., Weirton, $9,369. Noted July 10 under "Streets and Roads, and Bridges."

W. Va., Charleston—Kentucky rock asphalt on rein.-con. paving Morris and Elizabeth Sts., to K. E. Reed & Co., Charleston, $45,000.

Wisconsin — State and Washington Co. Hy. Comns., Div. Office, Commerce Bldg., Milwaukee, concrete paving Main St., Kewaskum, and West-Bend-Newburg Rd. to Froeming Bros., Inc., 1326 Humbolt Ave., Milwaukee, $17,177 and $88,978 respectively. Noted July 24.

Wis., Milwaukee — D. McKeith, comr., to Messenger Constr. Co., 5107 North Ave., paving alley between East Lincoln and East Smith Sts., $2,926; North 40th St., $4,439; and West Capitol Dr., $6,001—to Parkinson Constr. Co., 3515 Highland Ave. alley between North 39th and North 40th St., $1,732—South 16th St., to Czerwuishi Constr. Co., 816 Clinton St., South 16th St., $1,758; North 29th St., $2,631—to Bodermann Constr. Co., 1101 55th St., South 15th St., $12,033—to W. F. Hunt, 441 Bway., North Bway., $16,761. Grand total $48,281.

Wyoming — State Hy. Comn., Capitol, Cheyenne, reconstructing 0.757 mi. Albany Co., to Swenson Lumber Co., Laramie, $3,317—grading 7.216 mi. Converse Co., to Colby Boynsted & Olsen, Casper, $6,916—bridge on same job, to G. M. Guilford, Wheatland, $21,993—grading 5.794 mi. Crook Co., to Sharrck V. Pursell, Casper, $73,445—9.519 mi. Campbell Co., to J. J. Dooling, Pine Bluffs, $20,988—8.061 mi. Fremont Co., to Tyler & Baker Constr. Co., Cheyenne, $10,860—3 timber bridges Sublette Co., to Midland Constr. Co., Casper, $31,893. Grand total $169,423.

B. C., Vancouver—Concrete paving, to G. W. Ledingham, 348 East 8th Ave., $235,435.

Ontario—Dpt. P. Hys., Parliament Bldgs., Toronto, concrete culverts, grading 5½ mi. from Hanover to Walkerton, Contr. 30-64, to John Benstead and W. Yundt, Gadshill; 4.6 mi. Contr. 30-65, West from Contr. 30-50, to C. V. Dilly, 510 Oxford Ave., Montreal, Que. Est. $30,000.

Ontario — Dpt. Northern Development, Parliament Bldgs., Toronto, grading, 3 in. consolidated bituminous retread paving on 10 mi. Bracebridge and Huntsville Rd., to Bituminous Spraying & Contg. Co., Confederation Life Bldg., Toronto. Est. $75,000.

Ont., London—Middlesex Co., concrete paving 5½ mi. Heggerty Rd. and road from Strathburn to Glencoe, to Towland Constr. Co., Guelph, $130,000.

Ont., Toronto—B. S. Wemp, mayor, City Hall, asphalt paving Callendar St., to Constructing & Paving Co. Ltd., Confederation Life Bldg., $5,801—Avenue Rd. Contr. A, to McNamara Constr. Co. Ltd., 53 Yonge St., $17,157—Piper St., to owners by day labor, $13,556—concrete paving 2 lanes, to L. P. Acri, 28 Grove Ave., $2,461. Grand total $38,975.

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EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Calif., Santa Barbara — Santa Barbara Co., seawall along Cabrillo Blvd. between Milpas and Santa Barbara Sts. $75,000.

Ia., Sioux City—Woodbury Co., W. L. Egan, aud. 1½ mi. drainage ditch in Lower Lake-Port Drainage Dist.; 6 mi. Reynolds Creek Drainage Dist. E. L. Ferguson, United Bank Bldg., engr.

N. J., Deal —Bd. Boro Comrs., Boro Hall, plans timber bulkhead, stone jetties, on ocean front. $25,000.

Tex., Barreda — Cameron Co., Brownsville, irrigation system for 1,900 acres. $225,000.

Wash., Chelan—Howard Flat Irrigation District plans 1,200 acre irrigation project. W. T. Batcheller, Inc., Dexter Horton Bldg., Seattle, engr.

BIDS ASKED

Calif., Los Angeles—Aug. 20, by City Harbor Dpt., 121,000 cu.yd. dredging in West Basin, Los Angeles Harbor, Specification 866.

Calif., Santa Barbara—Aug. 21, by City Council, rip-rap, sheet piling and asphalt surfacing 3,000 ft. East Cabrillo Blvd, wall or revetment. $74,000 available. Noted Aug. 14.

Calif., North Long Beach (br. Long Island)—See "Railways."

Ill., Rock Island—City, bids about Aug. 16, rein.-con. river and rail terminal for use by Inland Waterway Corp. $200,000. W. F. Schulz, 870 Shrine Bldg., Memphis, Tenn., engr.

La., New Orleans—Aug. 19, by Bd. State Engineers, 207 New Orleans Court Bldg., 7 current retards or permeable crib deflection spurs with aggregate length of 1,050 ft. bank protection Hervey Canal Bend, Red River right bank in Caddo Parish, repairing existing structures Red River left bank, at Cat Island Bend in Bossier Parish; 6,100 ft. new levee work at Thompson; 3,176 ft. at Wild Lucia-Crescent; 1,690 ft. at Uni, all in Caddo Parish; 3,080 ft. at Robson; 2,800 ft. at Hollingsworth; 4,100 ft. at Chalk Level; 1,175 ft. Lacey Bayou, 1,494 ft. Van Hooso, all in Bossier Parish.

Mass., Boston—Aug. 19, by Dpt. P. Wks., State House, dredging 42,000 cu.yd. place measurement, 46,000 cu.yd. scow measurement in Boston Harbor adjacent to Bethlehem Shipbuilding Corp., East Boston. A. W. Dean, c/o Dpt. P. Wks., engr.

Miss., Biloxi—Sept. 2, by E. McManus, clk., Harrison Co., Gulfport, 7,000 ft. concave or step-type rein.-con. seawall, 5 ft. high, on Gulf of Mexico, west of here. $120,000. P. Bonham, Gulfport, engr. Noted July 31 under "Gulfport."

New Brunswick—Aug. 19, by N. Desjardins, secy., Dpt. P. Wks., Ottawa, Ont., breakwaters and breastworks at Tracadie Harbor. $25,000.

CONTRACTS AWARDED

Ariz., Phoenix—City, W. J. Jamieson, city engr., constructing protection along bank Verde River, to Mine Smelter & Supply Co., and N. B. McGinnis, Phoenix.

Ind., Marion—Comrs. Grant Co., constructing 34 mi. Pipe Creek Drain, to General Dredging Co., Ft. Wayne, $186,016.

N. J., Hoboken—Hoboken Land & Impvt. Co., 1 Newark St., constructing timber and concrete bulkhead foot 15th St. and Hudson River and timber steel and concrete pier foot 7th St. and Hudson River, to Allen N. Spooner & Son, Inc., Pier 11, North River, New York, est. $200,000 and $45,000 respectively.

B. C., Blubber Bay — N. Desjardines, secy. Dpt. P. Wks., Ottawa, Ont., dredging, to McKenzie Barge & Derrick Co., 2216 Cambridge St., Vancouver, $7,836. Est. $20,000. Noted May 22.

Ontario—Dpt. P. Wks., Ottawa, Drain 5 in Wallace, Howick and Grey Twps., to W. C. Drury, Arthur, $19,500.

Ontario—N. Desjardins, secy. Dpt. P. Wks., Ottawa, dredging Owen Sound, to W. L. Forrest, Goderich, Est. $12,768; Port Dalhousie, to Canadian Dredging Co., Ltd., 198 King St., Midland. Est. $12,000. Noted June 19.

Excavation, Drainage, Irrigation, Levees, River and Harbor (Continued)

Ont., Chatham—Chatham Twp. dredging 45,390 cu.yd. Danforth Creek Drain, to McLeary, Dean & Nigli, 1307 Highland Ave., Windsor; 6,060 cu.yd. Henderson Drain, to O. M. Loyer, Chatham; 2,080 cu.yd. Purdy Drain, to P. Hill, R. R. 5, Dresden; 1,290 cu.yd. Pollock and Town Line Drains, to J. H. Vandusen, R. R. 5, Dresden. Est. $35,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Calif., Sacramento—DREDGING—U. S. Eng. plans dredging 779,000 cu.yd. in San Joaquin River.

Ga., Savannah — PROTECTION WORKS — U. S. Eng., plans shore protection works on eastern shore of Fort Screven reservation, Tyler Island.

Ga., Savannah—REMODELING—Treas. Dpt. at office Sup. Archt., rejected bids July 14, extending and remodeling office and court house. Will readvertise. Noted June 19.

Ind., Fort Wayne—FEDERAL—Treas. Dpt. at office Sup. Archt., plans 3 story, basement, 150 x 180 ft., federal building. G. Mahurin, Fort Wayne, archt.

La., New Orleans—STONE, etc.—U. S. Eng., plans 10,000 tons stone and 118,750 lin.ft. B.M. 2 in. x 4 ft. x 16 in.

Me., Fort McKinley—BARRACKS—Con. Q.M., plans 2 story, 27 x 145 ft., (2 wings) barracks.

Texas—DREDGING—U. S. Eng., plans dredging channel at entrance to Dickinson Bayou, incl. removing 112,600 cu.yd. material.

Tex., Brownsville—POST BUILDINGS—Con. Q. M. plans remodeling buildings, heating units and mechanical equipment at Fort Brown Post, near here.

Tex., Randolph Field—HANGAR APRONS—Con. Q. M. plans 120 x 250 x 5 ft. rein.-con. hangar aprons.

Tex., Waco—HOSPITAL—U. S. Vet. Bur., Arlington Bldg., plans Neuropsychiatric Hospital group, incl. administration building, 2 or 3 hospitals, dining, kitchen, laundry, garage, storehouse, boiler plant, recreation hall, attendants quarters. Noted July 10.

BIDS ASKED

California — ROAD — Aug. 21, by C. H. Sweetser, dist. engr., U. S. Bur. P. Rds., 461 Market St., San Francisco, 4.514 mi. grading Hospital Rock to Giant Forest, Sequoia Natl. Forest, Tulare Co.

Connecticut—DREDGING—Sept. 12, by U. S. Eng. Providence, R. I., dredging 515,200 cu.yd. in Duck Island Harbor. Noted July 2 under "Providence, R. I."

Conn., Newington — SEWAGE DISPOSAL — Aug. 19, by Vet. Bu., Arlington Bldg., sewage disposal plant, at U. S. Vet. Hospital. Former bids rejected. Noted June 27.

Mass., Camp Devons—OFFICERS QUARTERS —Sept. 5, by Con. Q. M., 12 officers and 18 non-commissioned officers quarters. Noted May 29.

Mo., Baders Front—Sept. 3, by U. S. Eng., Memphis, Tenn., constructing 850 lin.ft. permeable crib dikes, in Mississippi River.

N. Y., New York—ASSAY OFFICE—Sept. 11, by Treas. Dpt. at office Sup. Archt., constructing (except elevators), U. S. Assay Office, (new); adv. E. N.-R. Aug. 14.

Tex., Randolph Field—CADET MESS HALL —Aug. 28 (extended date), by Con. Q. M., 2 story, basement, mess hall and recreation building; Cadet Barracks, Jobs 1 and 2. Noted July 24.

Tex., Randolph Field—GAS DISTRIBUTION SYSTEM—Sept. 3 (extended date), by Con. Q. M., 45,000 lin.ft. pipe, mains and laterals for natural gas distribution system. Noted July 24.

Tex., Randolph Field—HOSPITAL—Aug. 28, by Con. Q.M. 2 story, basement, hospital. W. E. Simpson Co., 942 Milam Bldg., San Antonio and G. Willis, Builders Exchange Bldg., archts. Noted July 24.

Utah, Fort Douglas—OFFICERS, QUARTERS —Sept. 3, by Con. Q. M., 6 officers quarters.

CONTRACTS AWARDED

Ariz., Prescott—POST OFFICE—Treas. Dpt., at office Sup. Archt., post office to R. E. McKee, 1918 Texas St., El Paso, Tex., $206,700. Noted July 12.

Ill., Chicago—QUARTERS—Vet. Bu., Arlington Bldg., officers quarters addition to Schmidt Bros. Constr. Co., 160 North LaSalle St., $275,565. Noted June 27.

La., Bogalusa—POST OFFICE—Treas. Dpt. at office Sup. Archt., post office to A. Blair, Montgomery, Ala., $93,390. Noted July 3.

Missouri—LEVEE—U. S. Eng., 428 Custom House, St. Louis, 26,000 cu.yd. earthwork in repairing levees in Genevieve Levee Dist. No. 1, to Keating Bros., 6014 Pershing Ave., St. Louis, at $0.209 per cu.yd. Noted July 10.

Missouri—DIKES—U. S. Eng., St. Louis, 4,000 ft. timber crib dikes in Mississippi River, Slim Island, to Woods Bros. Constr. Co., 132 South 13th St., Lincoln, Neb., $63,770. Noted July 3.

New York—DREDGING—U. S. Eng. Office, Army Bldg., Whitehall St., New York, dredging in Hudson River near Shad Island to National Dredging Co., 233 Bway., Item 1 and 2 at

N. D., Fargo—GARAGE and STOREHOUSE —Vet. Bur., Arlington Bldg., garage and storehouse to Meinecke-Johnson Co., Fargo, $17,408. Noted June 27.

Oregon—ROAD—U. S. Bur. P. Rds., Portland, grading 5.15 mi. National Forest Road, Harnay Co., to Marvimont Knudsen, Boise, Idaho, $43,048.

Tex., Randolph Field—ELECTRIC LIGHTING SYSTEM—Con. Q. M., electric lighting and telephone system to Harrison Wright Co., 4 West 3rd St., Charlotte, N. C., $59,900. Noted July 17.

Tex., Randolph Field — OPERATIONS — Operation and parachute building to Sumner Sollitt Co., Natl. Bank Commerce Co., San Antonio, $75,580.

Utah — ROAD — Bureau P. Rds., Ogden, grading, 4.785 mi. Alpine Scenic Highway, Wasatch Natl. Forest, Utah Co., to J. W. Whitning, Springville, $34,872. Noted July 31.

Wyoming—ROAD—Bureau P. Rds., Denver, Colo., grading, surfacing, 6.137 mi. Jackson-Wind River Natl. Forest Rd., Teton Natl. Forest, Teton Co., to Threet Bros., Lowell, $70,723. Noted June 26.

RAILWAYS

PROPOSED WORK

Indiana—City of Hammond, R. Seely, city engr., and New York Central R.R., F. B. Freeman, ch. engr., New York, Erie R.R., G. S. Fanning, ch. engr., New York, Chicago, Indianapolis & Louisville Ry., A. S. Kent, ch. engr., Chicago, Ill., New York, Chicago & St. Louis R.R., A. C. Harvey, ch. engr., Cleveland, O., and Belt Ry. Co. of Chicago, F. E. Morrow, ch. engr., Chicago, Ill., preliminary plans rerouting lines and elevating tracks, $13,000,000.

Pennsylvania—A. R. Raymer, ch. engr., Pittsburgh & Lake Erie R.R. Co., Terminal Bldg., Smithfield St., soon takes bids (selected list bidders), grading right-of-way, and masonry work for 3.5 mi. extension from Monaca to Bellowsville.

BIDS ASKED

California—Supervisers Los Angeles Co. taking bids 2,000 ft. railroad track, 12,500 tons rip rap along west levee of Los Angeles River from Louise St. to 52nd St. near North Long Beach, 1,200 railroad ties, 6 x 8 in. by 8 ft., 1 incised and creosoted O.P. for County Flood Control Dpt., Los Angeles.

CONTRACTS AWARDED

California and Oregon—Western Pacific R.R. Co., J. W. Williams, ch. engr., Mills Bldg., San Francisco, Calif., 111 mi. railroad between Bieber, Calif., and Klamath Falls, Ore., to W. A. Bechtel Co., 206 Sansome St., San Francisco, Calif., and Utah Constr. Co., Ogden, Utah. Est. $10,000,000. Noted July 17.

Oregon — Oregon Washington Railway and Navigation Co., Pittock Bldg., Portland, boring tunnel on line of change of alignment 2 mi. east of Rowena to J. F. Shea Co., Henry Bldg., Portland, $130,000.

Tennessee—St. Louis-San Francisco Ry., F. G Johan, ch. engr., Frisco Bldg., St. Louis, Mo. and Arkansas & Memphis Ry., Bridge Terminal Co., W. S. Martin, pres., 1333 Exch. Bldg., Memphis, bank revetment and pier support, for Frisco and Harahan bridges on Mississippi River, at Memphis and placing willow mattresses in bank revetment, rip rap work, around bridge piers, to Massman Constr. Co., 519 American Bank Bldg., Kansas City, Mo., $140,000.

SUBWAYS AND TUNNELS

PROPOSED WORK

Oregon — State Hy. Comm., Salem, plans Umhqua Highway, incl. 1,300 ft. tunnel through Elkton Mountain, R. Klein, state engr., U. S. Govt. and Douglas Co. to share cost.

BIDS ASKED

N. Y., New York—Aug. 22, by Bd. Transportation, J. H. Delaney, ch., 250 Hudson St., constructing Worth Street Connection, part Sect. 3, Route 101, Church and Franklin Sts.

Pa., Phila. — Sept. 5, by Dpt. City Transit, C. E. Myers, dir., City Hall annex, 4 track subway in market street, from 24th to 30th Sts. incl. demolishing and re-erecting Market St. Highway Bridge over Schuylkill River. Contr. 261.

CONTRACTS AWARDED

Mo., St. Louis—Illinois Terminal R.R. Co., E. S. Hight, ch. engr., double track subway under 12th St., from Cass Ave. to proposed terminal, 12th, High and Morgan Sts., Lucas Ave., by own forces, 2,000 ft. rein.-con. piles, to Smith & Brennan Concrete Pile Co., 4,000 North 1st St.

Ont., Brantford—City, subway under Canadian Natl. R.R. tracks, to Lothian & Co., Alexandria, $55,000.

GRADE CROSSINGS

PROPOSED WORK

N. Y., Babylon—Long Island R.R. Co., A. C. Watson, ch. engr., Pennsylvania Sta., New York, plans eliminating Deer Park Ave. crossing, and Half Hollow Crossing, at Deer Park Station.

Calif., Long Beach—See "Bridges."

DAMS

BIDS ASKED

Ark., Village Lake — Aug. 18, by Bd. Dir. Chicot Co. D. D., at office Chicot Trust Co., constructing earth dam across Dieth Bayou, near here. Dickinson & White, Little Rock, engrs.

N. Y., East Hamburg—Aug. 18, by Erie Co., T. H. McElvein, 263 Terrace St., 1 concrete core earthern dam at Chestnut Ridge Park, Erie Co. Park Comn., engr.

N. Y., Mayfield—Sept. 2, by Hudson River Regulating Dist., 44 Howard St. Albany, constructing Mayfield Dam, Fulton Co., E. H. Sargent, ch. engr.; adv. E. N.-R. Aug. 14.

PIERS AND WHARVES

PROPOSED WORK

La., New Orleans—WHARF—Bd. Comrs. Port of New Orleans, River Front, postponed taking bids reconstructing Charbonnet St. Wharf.

Md., Fairfield—PIERS—Maryland Dry Dock Co., new 875 x 32 ft. pier, extending 3 piers 140, 200 and 250 ft.

Mass., Cotuit—G. Roberts, Main St., timber piers, incl. fill solid, Cotuit Harbor. $25,000. Private plans.

Mass., Tisbury—Vineyard Grove Co., J. Donovan, mgr., Vineyard Haven, rebuilding pier at Vineyard Haven. $25,000. Private plans.

BIDS ASKED

Que., Beauharnois—WHARF—Aug. 19, by N. Desjardins, secy. Dpt. P. Wks., Ottawa, Ont. constructing close faced cribwork wharf. $25,000.

AIRPORTS

PROPOSED WORK

Conn., Hartford—Hartford Aviation Comn., H. P. Maxim, brick, steel terminal, incl. wireless, meteorological department, pilots quarters and passenger division, Brainard Field. $80,000. Private plans.

Ind., Gary—City, steel hangar and administration building on 320-acre airport. $1,000,000. Private plans.

N. J., Matawan — Matawan Airport, J. R. Lefferts, in charge, preliminary plans grading, paving airport, hangars. $50,000. Private plans.

Wyo., Rock Springs—Boeing Air Transport Co., c/o A. H. Humphries, vice pres., Cheyenne, plans hangar and administration building. $40,000.

CONTRACTS AWARDED

Calif., Alameda—Alameda Bay Airdrome, 120 x 440 ft. steel hangar and administration building, Webster St., to Lindgren & Swinerton, Inc., 225 Bush St., San Francisco, $100,000.

La., Natchitoches — City, 1 story, 80 x 100 ft. brick, steel hangar at municipal airport, to P. Prudhomme, Natchitoches, $12,176. Noted Sept. 12.

Miss., Meridian — City, improving airport, incl. 1 story, 94 x 101 ft., brick, concrete hangar, 2 story, 33 x 66 ft., administration building, to J. D. Watkins & Son, Meridian, $23,975. Noted June 19.

La., Baton Rouge—East Baton Rouge Police Jury Parish, administration building, hangar to A. C. Stewart, Baton Rouge, $50,602; plumbing and heating, to State Plumbing & Heating Co., Baton Rouge, $2,156; electrical work, to Baton Rouge Electric & Machine Co., Baton Rouge, $3,600. Grand total $56,358. Reported incorrectly under La., Baton Rouge, in Aug. 7 issue.

GRAIN ELEVATORS

CONTRACTS AWARDED

Ill., Calumet—GRAIN ELEVATOR—Rosenbaum Bros., 140 West Van Buren St., Chicago, 1,000,000 bu. grain elevator addition to M. A. Long Co., 332 South LaSalle St., Chicago.

Kan., Salina — GRAIN ELEVATOR — Salina Terminal Elevator Co., c/o J. J. Vanier, 500,000 bu. rein.-con. addition to grain elevator, to Chalmers & Borton, 620 Pioneer Trust Bldg., Kansas City.

POWER AND LIGHTING

BIDS ASKED

New York — Aug. 25, by Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, electric lighting on Saw Mill River Parkway, from Ashford Ave., Dobbs Ferry to Tarrytown Rd., Elmsford, J. Downer, engr.; adv. E. N.-R. Aug. 14.

N. Y., Long Island City—Aug. 19, by W. C. Martin, archt., supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, electrical work and lighting fixtures, for new P. S. 151, 31st Ave. from 50th to Hobart Sts., for Bd. Educ., 500 Park Ave., New York.

N. Y., New York—Aug. 29, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson Blvd., station and tunnel lighting equipment heating and ventilating for Independent System of City-owned rapid Transit R.R.

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Power and Lighting (Continued)

Wis., Milwaukee—Aug. 26, by Central Bd. Purchase Control, J. W. Nicholson, pruc. agent, 1,175 series street lighting transformer coils.

CONTRACTS AWARDED

N. Y., New York—Bd. Transportation, J. H. Delaney, ch., 250 Hudson St., station and tunnel signaling equipment for City Subways, to Jandous Electric Equip. Co., 210 East 40th St., $127,-000. Noted July 17.

Texas—Southwestern Public Service Co., subsidiary Commonwealth Power Corp., 120 Bway., New York, high power tension line from Amarillo, to Tascosa and tie into line of Texas Utilities Co. $250,000. Owner builds, C. Cox, genl. supt. in charge of company forces.

SPORTS AND PARKS

PROPOSED WORK

N. J., Fort Lee and Englewood — Bd. City Council, Municipal Bldg., plans converting Crystal Lake into a swimming pool, incl. sanding bottom of lake, installing chlorinators, bath houses, etc. $25,000. J. Paulga, Fort Lee, lessee. Noted July 17.

N. J., Linden—Bd. Educ., St. George Ave., preliminary plans playground, in rear of School 3, $25,000. H. B. Brady, Inc., 333 North Broad St., Elizabeth, archt.

O., Bedford (br. Cleveland) — Western Reserve Memorial Park Sales Co., W. R. Deaver, pres., Columbia Bldg., Cleveland, preliminary plans improving park, incl. grading, roadways, landscaping. $400,000. Nicolet & Griswold, Empire Bldg., Pittsburgh, Pa., engrs.

Okla., Bartlesville—City, W. N. Trautman, park supt., preliminary plans 70 x 150 ft., concrete grand stand, 2,000 seating capacity. $30,000. J. E. McCormick, City Hall, city engr., and Wood & Witten, 246 Lynch Bldg., Tulsa, consult. engrs.

Ont., Aurora—Town, 1 story, 100 x 150 ft., concrete, steel hockey arena, $25,000. James, Proctor & Redfern, 36 Toronto St., Toronto, engrs.

BIDS ASKED

Ont., Ottawa—A. J. Hazelgrove, archt., Ottawa, taking bids rein.-con., brick rink, plain found., Laurier Ave. W., for Rideau Curling & Badminton Club, 96 Victoria St. $100,000. Noted May 1.

CONTRACTS AWARDED

N. Y., Lake Placid — State Olympic Games Com., general contract bobsled run for Olympic Games, to L. A. Malone, Lake Placid, $59,488. Noted Jluy 31.

N. Y., New York—J. Miller, pres. Manhattan Boro, Municipal Bldg., general contract natatorium at Carmine Street Bath, to F. R. Green & Co., Inc., 215 4th Ave., $93,000. Noted

Ore., Portland—Portland Sports Arena, Inc., T. W. Ross, pres., 2 story, basement, 190 x 455 ft., sports arena, 1st, William, Harrio and Multnomah Sts., to L. W. Harrison Constr. Co., Portland, $400,000.

HEATING AND VENTILATING

BIDS ASKED

N. Y., New York—Aug. 18, by Bd. Higher Education, at office secretary Hunter College, Park Ave. and 68th St., heating, ventilating, plumbing, electrical work for Hunter College, Unit 2, at Bedford Park Blvd., Strong St., North Goulden, South Jerome, and Navy Aves.

N. Y., Orangeburg—Aug. 20, by Dpt. Mental Hygiene, Capitol, Albany, heating, sanitary work and equipment for kitchen equipment, Buildings 2, 3, 4, 13 and 39, and bakery ovens, machinery, for Building 45, Rockland State Hospital; adv. E. N.-R. Aug. 14.

N. Y., Rome—Aug. 29, by Commissioner Dpt. Education, State Education Bldg., Albany, heating, work, new boilers, at Central New York Institution for Deaf Mutes; adv. E. N.-R. Aug. 14.

CONTRACTS AWARDED

Ont., Guelph—Dpt. P. Wks., Parliament Bldgs., Toronto, steam heating, mains and pumping equipment at Ontario Agricultural College, to Sheppard & Abbott, 119 Harbord St., Toronto, $35,000. Noted Oct. 31 under "Schools."

UNCLASSIFIED

PROPOSED WORK

Ill., Rock Island—TERMINAL—See "Excavation, Drainage, Irrigation, Levees, River and Harbor."

Mass., Adams—TOWER—Commonwealth of Massachusetts, W. H. Sperry, 116 Pleasant St., North Adams, plans beacon memorial tower, Mt. Greylock. $25,000 or more. Reported incorrectly under Miss., Adams, in July 3 issue.

N. Y., Crown Point—Commissioner Conservation, State Office Bldg., Albany, rejected bids Aug. 1, for completing granite work, Champlain Memorial Lighthouse. Will readvertise. Noted Aug. 7.

Oklahoma—OIL PIPE LINE—Champlin Refining Co., Enid, plans 36 mi. 8 in. oil pipe line from Lovell to Oklahoma City oil field. $100,-000. Private plans.

Wis., Superior — OIL STORAGE TANK — Archer-Daniels-Midland Co., 29th Ave. S. E., Minneapolis, Minn., plans storage tanks Connor's Point.

BIDS ASKED

Ill., Chicago—TESTING EQUIPMENT—Oct. 15, by Bureau of Standards, Master Scale Depot, 5800 West 69th St., Clearing Sta., constructing master railroad scale testing equipment; adv. E. N.-R. Aug. 14.

N. Y., Crown Point—GRANITE WORK—Aug. 21, by Commissioner Conservation, State Office Bldg., Albany, constructing and completing granite work, for Champlain Memorial Lighthouse; adv. E. N.-R. Aug. 14. Noted Aug. 7.

N. Y., New York—STATION FINISH WORK—Aug. 22, by Bd. Transportation, J. H. Delaney, ch., 250 Hudson St., constructing station finish work for part 14th Street Eastern Rapid Transit R.R.

CONTRACTS AWARDED

California—PIPE LINE—Southern California Gas Co., Temple and Olive Sts., 24 mi. 22 in. pipe line between Castaic and Santa Monica, to Macco Constr. Co., 815 Ocean Ave., Clearwater, $800,000.

Conn., New Haven — CONCRETE MIXING TOWER — C. W. Blakeslee & Sons, 58 Waverly St., steel, concrete, 19 Gibbs St., $25,000 incl. machinery. Owner builds. Private plans.

La., Lake Charles—SPRINKLER SYSTEM—Lake Charles Harbor & Terminal Dist., Bd. Comrs., Association of Commerce Bldg., automatic sprinkler system for wharf floor, in sheds and beneath wharf floor, to Craft-Rushworth, Ltd., Lake Charles, $37,166.

N. Y., New York—CRANE EQUIPMENT—Bd. Transportation, J. H. Delaney, ch. engr., crane equipment to Harnischfeger Sales Co., 50 Church St., $173,385.

O., Cleveland—CHIMNEY—Industrial Rayon Corp., H. S. Rivitz, pres., West 98th St. and Walworth Ave., 50 x 50 ft. radial brick stack, 300 ft. high, on concrete found., 19 ft. deep, to George A. Rutherford Co., 2725 Prospect Ave., est. $200,000. Noted Aug. 7.

Texas—OIL PIPE LINE—Pasotex Oil & Pipe Line Co., Womble Bldg., El Paso, 40 mi. 4 in. oil pipe line from Porterville District to Loving, $45,000. Owners build. Private plans.

Wyoming—Sheridan Gas & Fuel Co., Sheridan, 90 mi. 6 in. gas line from Billy Creek gas field to Sheridan, via Buffalo to Hope Eng. Co., Mount Vernon, O.

MATERIALS

BIDS ASKED

TENSION COILS—**Los Angeles, Calif.**—Aug. 27, by T. Oughton, city purch. agt., 3 sets high or low tension coils, 1 set cooling coils, 3 set high or low tension coils on 3 laminated iron cores.

LUBRICATING OIL—**Connecticut**—Aug. 18, by State Hy. Comn., Hartford, 23,000 gal. petroleum lubricating oil. J. A. Macdonald, 12 Washington St., engr.

NATURAL ROCK ASPHALT—**Laporte, Ind.**—Aug. 16, by Comrs., Laporte Co., 100 tons natural rock asphalt. To exceed $5,000. E. L. Alexander, Laporte, engr.

GRAVEL—**Anamosa, Ia.**—Aug. 22, at office Auditor Jones Co. 8,000 cu.yd. maintenance gravel. F. S. Yetter, Anamosa, co. engr.

STEAM ASHES—**Long Island City, N. Y.**—Aug. 18, by G. U. Harvey, pres. Queens Boro, 20,000 tons steam ashes on trucks; 400,000 gal. asphaltic macadam binder; and 200,000 gal. calcium chloride, in tank cars.

CONTRACTS AWARDED

PIPE—**Kansas City, Kan.**—City, cast iron pipe, to U. S. Pipe & Fdry. Co., 417 East 13th St., Kansas City, Mo., $37,853.

ASPHALT, etc.—**Boston, Mass.**—Transit Dpt., 250 tons asphalt, 100,000 sq.yd. asphalt saturated waterproofing fabric, to Minwax Co., Inc., 11 West 42nd St., New York, $22 per ton and $0.137 per sq.yd. respectively; 1,300,000 lbs. reinforcing rods to Kalman Steel Co., 333 Washington St., Boston, $26,220. Noted. July 24.

LUMBER—**Minneapolis, Minn.**—F. S. Grant, city purch. agt., 144,413 ft. creosoted douglas fir timber, 4 x 12 x 18 ft., 4 x 12 x 20 ft., and 8 x 10 x16 ft., to Wheeler Lumber, Bridge & Supply Co., 628 Lumber Exch., at $54.40 per 1,000; 42,600 ft. 3 x 10 ft. untreated, to Thompson Lumber Co., 917 Washington Ave. S. E., $30.50.

SAND—**Missouri**—F. B. Jones, Dir. Penal Institution, Jefferson City, 100 carloads of building sand for Intermediate Reformatory, 2 mi. from Osage, to Thompson-Young Sand Co., Osage, City, at $0.96 delivered near site.

BRIDGE CULVERT PIPE—**Texas and Kansas**—Atchison Topeka & Santa Fe Ry. Co., G. W. Harris, ch. engr., Chicago, Ill., 18 carloads 6- to 12-in. culvert pipe for use in Texas and Kansas, to American Casting Co., East Birmingham, Ala.

EQUIPMENT

BIDS ASKED

TRACTOR — **Hemet, Calif.** — City in market tractor, grader, street sweeper for Street Dpt. Noted May 29.

PUMP—**San Francisco, Calif.**—A. C. Griewank, engr., 208 Mission St., taking bids deep well turbine pump, 60-hp. boiler for factory, for Eng-Skell Co., 208 Mission St.

STEAM SHOVEL TRAILER—**Wellesley Hill, Mass.**—Wellesley Hill Excavating Co., Inc., in market, steam shovel trailer, to carry 35 tons.

GASOLINE ROLLER, etc.—**Corinth, Miss.**—Aug. 18, by J. A. Lowe, mayor, and Bd. Aldermen, furnishing one modern 10-ton combination gasoline roller, usable for rolling asphalt, laid hot or cold, with scarifier.

CRUSHING PLANT—**Valleyfield, Que.**—R. Belanger, city engr., in market, 30-ton stone crushing plant, per hour capacity, concrete mixer, 21 cu.ft. capacity, 2 carloads 6- to 12-in. c.i. water pipe, 12 fire hydrants.

CONTRACTS AWARDED

AIR DUMP CARS—**New York, N. Y.**—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., 4 air dump cars on track in 207th Street yard to Magor Co., 50 Church St., $39,160.

Buildings

RESIDENTIAL

BIDS ASKED

N. J., Lakewood — Lakewood Milk & Rest Cure, Inc., 154 Nassau St., New York, bids about Sept. 2, general contract 2 story, basement, brick, steel, hotel, sanitarium, $300,000. H. Ginsberg, 205 East 42nd St., New York, archts. Noted July 10.

N. J., Red Bank—S. Trubin, 74 Broad St., taking bids general contract 5 story, basement, brick, steel, plain found., $150,000. Former bids rejected. E. Wierzbricki, 175 Smith St., Perth Amboy, archt. Noted June 12.

CONTRACTS AWARDED

Calif., Fresno—H. A. Chalmers Co., 277 21st Ave., San Francisco, 4 story, basement, steel, brick, Mariposa St., to Laughlin Constr. Co., Mills Bldg., San Francisco, $175,000.

Calif., Modesto—Hotel Covell, concrete, brick hotel addition, to E. K. Nelson Co., 557 Market St., San Francisco, $150,000.

Calif., Redwood City—M. E. Ryan, 231 Main St., 3 story, basement, concrete, Duane St., to Russell & Duncan, 231 Main St., $150,000.

Calif., San Francisco—Suncal Investment Co., c/o A. H. Larsen, 447 Sutter St., 6 story, basement, rein.-con., Waller St. and Buena Vista Ave., to Mission Concrete Co., 270 Turk St., $175,000.

Tex., Point Isabel—Point Isabel Bridge Co. Inc., Point Isabel, 5 story basement, brick, rein.-con., hollow tile hotel, plain found., at end of Causeway Blvd. and Causeway over Laguna Madre, to General Engineering & Development Corp., 175 5th Ave., New York. Est. $350,000.

CLUBS

PROPOSED WORK

N. Y., New York—National Bureau Y.M.C.A., 347 Madison Ave., New York plans by A. L. Mackenzie, 5 East 57th St., negro branch Y.M.C.A., 174-184 135th St., $1,000,000. Noted Feb. 6.

BIDS ASKED

N. J., Perth Amboy—E. Wierbicke, archt., 175 Smith St., bids about Sept. 15, general contract 3 story, basement, brick, steel, plain found., Elm St. for Fourth Ward Polish Citizens Club, c/o archt. Noted July 31.

CONTRACTS AWARDED

Ill., Chicago—Perkins, Chatten & Hammond, archts., 160 North La Salle St., general contract 23 story, basement, 104 x 139 ft., Y.M.C.A. to Jacobson Bros., 53 West Jackson Blvd., for Young Men's Christian Assn., 19 South La Salle St., heating to Mehring & Hanson Co., 1463 Pensacola Ave.; plumbing to H. P. Reger & Co., 159 North State St., and elevators to Otis Elevator Co., 600 West Jackson Blvd., est. $2,700,000. Noted Mar. 13.

HOSPITALS

PROPOSED WORK

Massachusetts — Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, rejected bids 5 story, basement, brick, steel attendants home and assembly building at Metropolitan Hospital, Trapelo Rd., Waltham, Lexington and Belmont. To exceed $150,000.

Mass., Boston — Massachusetts General Hospital, A. Washburn, in charge, Fruit St., nurses home, North Grove St. $200,000 or more. Architect not selected.

N. Y., Schenectady—Ellis Hospital, Nott St., plans by Heacock & Hokanson, 1211 Chestnut St., Phila., Pa., 7 story, basement, 45 x 150 ft., brick, rein.-con., plain found. $750,000.

N. Y., Suffern — Good Samaritan Hospitals plan hospital. $150,000.

Pa., Phila. — Penn Treaty Hospital, S. A. Peter, pres., 820 East Gerard St., plans by S. J. Laschenski, 15th and Mart Ave., 5 story, basement, 50 x 90 ft., brick, steel, rein.-con., Gerard and Fletcher Aves. $150,000.

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Hospitals (Continued)

Vt., Barre — Barre City Hospital, F. E. Langley, chn. Bd. Trustees, plans by Stevens & Lee, 45 Newbury St., Boston, Mass., altering and constructing 2 story, basement, brick, concrete, Washington St. $150,000.

BIDS ASKED

Mass., Danvers — Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, taking bids altering 3 story, basement, brick, rear centre building, Danvers State Hospital. $300,000. M. P. Meade, 80 Boylston St., Boston, archt. Noted July 31.

Mass., Springfield—Aug. 28, by City, F. C. Parker, mayor, 3 and 5 story, 45 x 112 ft. and 4 x 190 ft., brick, steel isolation hospital, State St. $600,000. Kirkham & Parlett, 25 Harrison Ave., archts. Noted July 3.

N. J., Pinehurst—Lincoln Sanitarium, 124 West 45th St., New York, taking bids three 85 x 100 ft. sanitarium buildings, two 30 x 60 ft. doctor residences. $500,000. Private plans.

CONTRACTS AWARDED

Calif., Los Angeles—Santa Fe Hospital Assn., 610 South St. Louis St., 3 story, basement, rein.-con. dormitory, 6th and Louis Sts., to Lynch Constr. Co., 730 Merrill St. $175,000.

Conn., Newtown—State, Fairfield State Hospital Comn., Hartford, general contract 10 buildings, to Abbadessa & Bros., Inc., 159 Winthrop Ave., New Haven, $8700.00; plumbing, to M. J. Daly & Sons, Bank St., Waterbury, $81,267; heating, to Libby & Blinn, 135 Sheldon St., Hartford, $158,770; electrical work, to Billings Electric Co., 47 Lyle Rd., New Britain $63,752; engines, generators, to Ames Engineering Co., Boston, Mass., $42,984; refrigeration work, to York Ice Machinery Co., 200 Causeway, Boston, Mass, $37,250. Total est. $1,750,000. Noted July 10.

Me., Lewiston—Central Maine General Hospital, altering and constructing 2 story, basement, brick, steel addition, plain found., Main St., to J. H. Kerr, Prospect Ave., Rumford. Est. $150,000. Noted June 26.

Mass., Mattapan (sta. Boston) — Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, 2 and 3 story, basement, brick, stone, granite employees building, plain founds., at Boston State Hospital, to Mozzicato & DiPietro, 12 Hancock St., Medford. Est. $150,000.

Mo., Richmond Heights—St. Mary's Hospital, c/o Sister Irene, 642 Clayton Rd., 6 story, basement, 35 x 125 ft., brick, rein.-con., stone, hospital addition, nurses home and school, 6420 Clayton Rd., to Wimmer Contg., 916 Victoria Bldg., St. Louis.

Okla., Vinita—Eastern Hospital for Insane, c/o Bd. Affairs, State Capitol, Oklahoma City, 2 story, basement, 83 x 83 x 184 ft., rein.-con., brick, stone ward building, to H. L. Buchanan, Fort Smith, Ark., and J. D. Mann Co., 815 West Main St., Oklahoma City, $132,555.

CHURCHES

BIDS ASKED

N. J., Arlington—Myers & Shanley, archts., 24 Walnut St., Newark, bids about Oct. 15, general contract 2 story, basement, brick, steel, seminary, for Immaculate Conception Seminary, c/o archt. Noted Aug. 7.

N. J., Jersey City—Fanning & Shaw, archts., 49 Ward St., Paterson, taking bids general contract 2 story, basement, 50 x 115 ft., brick, steel, Ocean Ave. and Forrest St., for Church of Christ the King, J. Shovlin, rector, c/o archt. $150,000.

N. J., Mendham—Aug. 18 (extended date), by R. J. Reilley, archt., 12 East 41st St., New York, 4 story, basement, tower, convent, 1 story, basement, 58 x 155 ft. chapel, for sisters of Christian Charity, Menham. $150,000. Noted May 8.

CONTRACTS AWARDED

Mass., Grafton — Commonwealth of Massachusetts, Dpt. and Mental Diseases, State House, Boston, 1 and 2 story, balcony and basement, brick, stone chapel and recreation building at State Hospital, plain found., to R. G. Munroe, Plainville. Est. $150,000. Noted July 31.

O., Lorain—Agudath Archim Congregation, I. Mill, rabbi, 2 story, basement, 70 x 105 ft., steel, stone, concrete Jewish Temple and Community Center, 9th and Reid Sts., to L. A. Burgett Co., 8th St. and Bway. Est. $150,000. Noted May 8.

SCHOOLS

PROPOSED WORK

N. J., Elizabeth — Bd. Educ., 417 South Broad St., school, South St., $200,000; school, South Broad St., $150,000, both 2 story, basement, brick, steel. H. B. Brady, Inc., 333 North Broad St., probable archts.

N. J., Elizabeth—Bd. Educ., 417 South Broad St., 3 story, basement, brick, steel, addition to Jefferson High School, 20 Morrell St. $250,000. H. B. Brady, Inc., 333 North Broad St., probable archt.

N. J., Elizabeth — Bd. Educ., 417 South Broad St., 3 story, basement boys vocational school, brick, steel, rein.-con. $500,000. H. B. Brady, Inc., 333 North Broad St., probable archt.

N. J., Hillside—Bd. Educ., Twp. Hall, plans by J. Wind, Jr., 1450 North Broad St., 2 story, basement, brick, steel, school, Leslie St. and Winans Ave., $165,000—and 2 story, basement, school, Convent and Winchester Sts. Noted July 10 and 17.

N. J., Long Branch—Bd. Educ. plans by Seymour & Braun, 191 Bway., altering and constructing 2 story, basement addition, $150,000.

N. J., Monroe—Monroe Twp. Bd. Educ., G. Mount, dist. clk., School House, Prospect Plains, 2 story, basement, brick, steel, Jamesburg-Englishtown Rd. $150,000. Engineer and architect not selected.

N. J., Newton—Bd. Educ., High School, plans by Hacker & Hacker, 201 Main St., Fort Lee, Junior High School, 2 story, basement, brick, steel, $150,000. Noted July 17.

N. J., Piscatawaytown — Bd. Educ. Raritan Twp. sketches by Jensen & Rasmussen, 218 Smith St., Perth Amboy, 2 story, basement addition to Oak Tree School. $150,000. Noted Apr. 3.

N. J., Piscatawaytown — Bd. Educ. Raritan Twp., revised sketches by A. Merchant, 1 Elm Row, New Brunswick, Piscatawaytown School, 2 story, basement, brick, steel, rein.-con. $150,000.

N. J., Summit—Bd. Educ., 272 Morris Ave., plans by Guilbert & Betelle, 20 Branford Pl., Newark, 2 story, brick, steel, rein.-con. addition to Franklin School, Blackburn Rd. $150,000. Noted July 3.

N. Y., Arrochar—Sisters of St. John Baptist, Cleveland Pl., St. George, plans by DePace & Juster, 151 West 46th St., New York, 2 story, basement, brick, steel school, dormitory, plain found. $150,000. Noted July 24.

N. Y., Marathon—City Central High School, C. E. Carter, dist. supt.

N. Y., New York — St. Anthony's Roman Catholic Church, 1495 Commonwealth Ave., plans by M. W. Del Gaudio, 545 5ht Ave., 3 story, 75 x 120 ft., school, auditorium, gymnasium, Lawrence Ave. and Mansion St. $250,000.

Pa., Aliquippa — Bd. Educ., I. C. Wright, pres., 110 Major St., plans by Carlisle & Sharrer, Martin Bldg., N. S. Pittsburgh, school, Copper Farm Plan. $150,000.

Pa., Erie—Bd. Educ., S. W. Reicherd, pres., Library Bldg., plans by Myers & Johnson, 821 Commerce Bldg., Edison Elementary School, 2 story, brick, steel, East Lake Rd. and Bacon St., $185,000.

Pa., Grove City—Grove City College plans by W. G. Eckles, Lawrence Savings & Trust Bldg., New Castle, 3 story, brick, hollow tile, steel dormitory, Mercer Co. $200,000.

Pa., Grove City—Grove City College plans by W. G. Eckles & Co., Lawrence Savings & Trust Co., New Castle, 2 story, 100 x 300 ft., brick, steel, hollow tile science building, on campus. $300,000.

Pa., Pittsburgh—Bd. Educ., H. W. Cramblet, secy., Administration Bldg., sketches by Link Weber & Bowers, 407 North Craig St., Lincoln Elementary School, brick, steel, Lincoln Ave. near McAdams St. $262,000. C. L. Woolridge, Inc., Fulton Bldg., consult. engr. Noted July 10.

BIDS ASKED

Calif., Santa Ana — Bd. Educ. taking bids Willard High School, 2 story, 30-room, rein.-con. $150,000. Noted May 1.

Conn., Lakeville — Aug. 15, by Hotchkiss School, brick, stone chapel and dormitory unit for school, here. Est. exceeds $150,000. Delano & Aldrich, 128 East 38th St., New York, archts. Noted May 22 under "Salisbury."

Del., Greenwood—Delaware School Foundation, A. J. Taylor, vice pres., Du Pont Bldg., Wilmington, bids about Sept. 15, general contract, 3 story, basement, brick, rein.-con., steel, plain found., $150,000. Guilbert & Betelle, 20 Branford Pl., Newark, N. J., archts. Noted July 31.

Ill., Chicago—Aug. 26, by Bd. Educ., 188 West Randolph St., general contract Gresham School addition, South Green and 85th Sts., $350,000. P. Gerhardt, 188 West Randolph St., archt.

Ind., Williams—Aug. 14, by School Comrs., 2 story, basement, brick, steel, stone high school. $150,000. O. L. Hill, Bedford, archt.

Ia., Ft. Dodge—Aug. 19, by Bd. Educ., E. E. Peterson, secy., 2 story, basement, rein.-con., brick, stone Junior High School, $200,000. E. O. Damon, Jr., 19 East Mason Bldg., archt., and F. W. Griffith, 400 Snell Bldg., associate archts. Noted Aug. 7 under "Contracts Awarded."

Ky., Covington—Aug. 15, by Bd. Educ., 3 story, basement, rein.-con., brick school, plain found., Greenup St. $250,000. C. L. Hildreth, Coppin Bldg., archt.

La., Vivian—Aug. 20, by Caddo Parish School Bd., E. W. Jones, supt., 2 story, basement, rein.-con., brick addition. E. F. Neild, City Bank Bldg., Shreveport, archt. Noted July 31.

Md., Baltimore—Aug. 19, by Smith & May, archts., Calvert Bldg., 3 story, basement, irregular sized, brick, steel, rein.-con. law building, Redwood and Greene Sts., for University of Maryland, $155,000. H. Massart, 324 North Charles St., engr. Noted July 10.

Mass., Holyoke — Aug. 15, by City, F. G. Burnham, mayor, City Hall, 2 story, basement, brick, steel, elementary school, plain found., Maple St., $375,000. Allens & Collins, 75 Newbury St., Boston, archts. Noted June 5.

Mass., Westfield—Aug. 18 (extended date), by City Finance Com., City Hall, Boys Trade School, 3 story, basement, 75 x 180 ft., brick, stone, plain found., Bartlett St. $175,000-$200,000. M. W. Maloney, 23 Pearl St., Springfield archt. Noted Aug. 7.

Mass., West Quincy (mail Braintree) — St. Mary's Parish, c/o W. B. Colleary, archt., 80 Boylston St., Boston, taking bids 2 story, basement, brick, stone school, plain found., Crescent St. $150,000.

Mich., Detroit—Aug. 20, by C. A. Gadd, business mgr., Bd. Educ., 1354 Broadway Ave., 2 story, basement, brick, steel, concrete school, boiler house and heating plant addition, plain founds., Braden St. $160,000. Donaldson & Meier, 11888 First Natl. Bank, archts. Noted June 12.

Mo., Webster Groves—G. E. Henderson, archt., 1398 Arcade Bldg., St. Louis, taking bids two 3 story, basement, 38 x 87 ft., brick, concrete dormitories for Epworth School. M. Norling, supt.

N. J., Leonardo—Bd. Educ. Middletown Twp., W. Petingale, secy., bids about Sept. 2, general contract 2 story, basement, brick, steel, Leonardo School, plain found., $180,000. E. A. Arend, Kinmouth Bldg., Asbury Park, archt. Noted Aug. 7.

N. J., Linden—Bd. Educ., St. George Ave., bids about Sept. 15, general contract 2 story, basement, brick, steel, rein.-con., School 2 addition, Wood Ave. $150,000. H. B. Brady, Inc., 333 North Broad St., Elizabeth, archt. Noted July 24.

N. J., Perth Amboy — Bd. Educ., 261 State St., bids about Sept. 15, general contract altering 3 story, basement, brick, steel, addition incl. gymnasium, cafeteria, Madison Ave. $150,000. Greisen & Tuzig, 175 Smith St., archts. Noted July 24.

O., Columbus—Sept. 5, by Bd. Trustees, Ohio State University, C. L. Steeb, secy., 3 story, basement, 65 x 280 ft., rein.-con., brick, Indiana limestone, teachers training school, campus. $400,000. H. Dwight Smith, Ohio State University, archt.

Pa., Beaverdale — Aug. 18, by Bd. Educ., Summerhill Twp., J. A. Boncher, pres., Beaverdale, rebuilding 2 story, 70 x 156 ft., brick, steel school, Summerhill Twp. after fire. $150,000. Vans Engr. Service, Blairsville, H. M. Rodgers, Johnstown Trust Bldg., Johnstown, archts.

Pa., Somerset—Aug. 21, by Bd. Educ., J. J. Walker, secy., East Union Ave., 3 story, 60 x 130 ft., brick high school addition. $150,000. E. H. Walker & Mong, 226 East Church St., archts.

CONTRACTS AWARDED

Calif., Santa Cruz—Bd. Educ., general contract 2 story, rein.-con., to Wilson & McGranahan, Santa Cruz, $91,894. Est. $165,000. Noted July 17.

Del., Laurel — Delaware School Foundation, A. J. Taylor, vice-pres., Du Pont Bldg., Wilmington, general contract 2 story, basement, 68 x 220 ft., brick, steel addition, plain found., to Northeastern Constr. Co., 6 West Madison St., Baltimore, Md., $128,777; plumbing and heating to Pocomoke Foundry & Machine Wks., Pocomoke City, Md., $25,373. Noted July 10.

Ill., Chicago—Bd. Educ., 188 West Randolph St., general contract Joyce Kilmer School, to A. and E. Anderson Co., 228 North LaSalle St., $79,448; plastering, to Lennox Halderman Co., 208 South LaSalle St., $25,990; carpentry, to E. E. Young, 7553 Creigier St., $31,500; painting, to G. E. Hart, Inc., 511 South Crawford St., $8,376; fireproofing, to T. G. Nicholson Co., 53 West Jackson Blvd., $16,826; sheet metal, to Wagner Bros. Cornice Co., 1010 Diversey St., $5,924; marble, to M. Keating & Sons Co., 4046 Wentworth Ave., $3,415; terrazzo, to American Mosaic & Terrazzo Co., 1730 Carroll Ave., $11,667; tile, to Erdmann Co., 7300 Kimbark Ave., $4,106; glass, to Simpson Clark Glass Co., 130 West Austin Ave., $2,000; tar and gravel roofing, to Esko Roofing Co., 2651 West Washington Blvd., $1,626; steam heating, to T. J. Douglas & Co., 352 Whiting Ave., $26,700; plumbing, to Noble & Thumm Co., 1065 Addison St., $13,973; ventilating, to K. A. Gustafson Co., 2106 North Springfield St., $23,350; heating regulation, to Johnson Service Co., 1355 West Washington Blvd., $2,420. Grand total $257,321.

Ind., East Chicago—School Comrs., general brick, steel grade school, to C. Hansen, 604 State Line St., Calumet City, Ill. Est. $150,000. Noted Aug. 7.

Ia., Dubuque—Academy of Visitation, Sisters of the Visitation, c/o Mother M. Catherine, superior, 4 story, rein.-con., brick convent, to W. L. Yokom, Inc., Dubuque, $150,000; heating and plumbing, to Mullen Bros. & Co., Dubuque, $35,000. Noted July 17.

Mass., Boston—Gordon College of Theology & Missions, 30 Evans Way, altering and constructing 3 story, basement, brick, steel addition, caisson found., to William Coulson Co., 238 Mains St., Cambridge. Est. $150,000.

Mich., Detroit — Bd. Educ., 1354 Broadway Ave., general contract 2 story, basement, brick, steel, concrete, stone school, plain found., Wildemere St., to Rutherford-Sickler Co., 415 Brainard St. Est. $150,000.

Minn., Minneapolis—Holy Angels Academy, Sisters of St. Joseph, 1890 Randolph St., St. Paul, 4 story, basement, brick, stone, rein.-con., 66th St. and Nicollet Ave., to W. Butler Co., 630 Hamm Bldg., St. Paul, est. $600,000.

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Schools (Continued)

N. H., Portsmouth—City School Comn., Junior High School, 2 story, basement, brick, steel, concrete, plain found., to C. H. Cunningham & Son Co., 23 Central Ave., Lynn, $354,500. Noted July 17.

N. J., Riverdale—Bd. Educ., School Bldg., general contract 2 story, basement, brick, steel, to A. DeNicola, 717 30th St., Union City, est. $150,000. Noted July 24. Plumbing to H. Van Varick, 281 Hillman St., Clifton; heating to G. Stewart, 270 South 20th St., Newark; electrical work to J. R. Proctor, 16 West 9th St., Bayonne.

N. J., Trenton—School Bd., general contract school addition, at Slackwood to Barlow & Akers, Trenton, $76,878. Noted June 12.

N. Y., New York — St. Anthony's Roman Catholic Church, 1495 Commonwealth Ave., 3 story, 75 x 120 ft., school, auditorium and gymnasium, to R. Tosti, 2324 Cambreling Ave., est. $250,000.

N. Y., Mineola—Mineola School Dist., 2 story, school, Williston Park, to P. N. Krug, Minneola, est. $252,000.

N. D., Fargo—Bd. Educ., general contract 2 story, basement, brick, steel, rein.-con., to S. Wilson, 1326 3rd Ave., South Fargo, $82,421. Noted July 17.

THEATRES

CONTRACTS AWARDED

Ill., Chicago—J. E. O. Pridmore, archt., 38 South Dearborn St., 1 story, balcony, rein.-con., brick, terra cotta, to Pashen Bros., 33 North LaSalle St., for Balaban & Katz, 175 North State St., est. $500,000. Noted July 17.

Ky., Ashland — Hibernia Securities Corp., Hibernia Bank Bldg., New Orleans, La., theatre and office building, to Kiser-Ducet Co., Joliet, Ill., $150,000. Noted Mar. 20.

BANKS

CONTRACTS AWARDED

Ill., Chicago — Chatfield Trust & Savings Bank, 7736 Cottage Grove Ave., 2 and 3 story, 75 x 107 ft., bank to M. Rune & Sons, 6753 Stoney Island Ave., est. $150,000. Noted July 3.

N. J., Elizabeth—Central Home Trust Co., N. R. Leavitt, pres., 280 North Broad St., general contract 2 story, basement, brick, steel, plain found. to Hoggson Bros., 485 5th Ave., New York, est. $150,000.

N. J., Secaucus — First National Bank of Secaucus, L. Hucker, pres., general contract altering 2 story, basement, brick, steel, bank and office addition, to J. Venturo, 678 Johnson Pl., West New York, est. $150,000. Noted July 3.

STORES

BIDS ASKED

N. J., Jersey City—M. A. Wolfe, archt., 845 Broad St., Newark, general contract bids about Sept. 2, 3 story, basement, brick, steel, store and apartments, Manhattan and Terrace Aves. for A. Cordano, c/o archt. Noted Aug. 1.

CONTRACTS AWARDED

N. J., Perth Amboy—J. N. Pierson & Son, archt., 198 Jefferson St., general contract 2 story, basement, brick, steel, department store addition, to Perth Amboy Constr. Co., 61 Madison Ave., est. $150,000. Noted July 24.

PUBLIC

PROPOSED WORK

Mass., Braintree — FIRE and POLICE STATION—Town, E. Avery, chn. com., soon takes bids 2 story, basement, brick, steel, concrete central fire and police station, plain found. $150,000. C. G. Loring, 7 Water St., Boston, archt. Noted June 19.

N. J., Rahway—REFORMATORY—Dpt. Institutions & Agencies, State Office Bldg., Trenton, recalled bid to have been opened July 29, for main building for reformatory, $150,000. Noted July 24.

N. Y., Auburn—POLICE and FIRE STATION—Bd. Fire & Police, soon takes bids police and fire station, $325,000.

Ont., Toronto—POLICE ADMINISTRATION—City soon takes bids 3 story, stone, steel, concrete, concrete found., Fleet and York Sts. $250,000. J. J. Woolnough, City Hall, city archt. Noted June 5.

BIDS ASKED

Mass., Westboro—CHAPEL, etc.—Aug. 19, by Bd. Trustees, 41 Mt. Vernon St., 1 and 2 story, basement, brick, stone, chapel and assembly building plain found., at Lyman School for Boys, for Commonwealth of Massachusetts, Dpt. P. Welfare, Boston. $150,000. Densmore, LeClear & Robbins, Park Sq. Bldg., Boston, archts. Noted June 5 under "Bids Asked."

Ind., East Chicago—LIBRARY—Bd. Trustees, bids about Aug. 15, steel, limestone, $150,000. K. D. Norris, East Chicago, archt.

Ind., Portland—FIRE STATION—Aug. 30, by C. V. Gott, mayor, brick, steel, stone fire station, $150,000. Houck & Smeuner, Muncie, archt.

S. D., Philip—COURT HOUSE—Aug. 26, by J. S. Snow, aud., Haakon Co., 4 story, basement, 70 x 80 ft., brick, rein.-con., $150,000. Perkins & McWayne, 322 Paulton Block, Sioux Falls, archts. Noted June 13, 1929.

Tex., Beaumont—COURT HOUSE—Sept. 3, by Jefferson Co., B. B. Johnson, judge, 8 story, brick, stone, steel, rein.-con., court house, $1,000,000. A. Babin, 417 Perlstein Bldg., and F. C. Stone, 1105 Goodhue Bldg., associate archts. Noted July 24.

Que., Farnham—PUBLIC—Aug. 21, by N. Desjardins, secy. Dpt. P. Wks., Ottawa, Ont., public building, $30,000.

CONTRACTS AWARDED

Mass., Brighton (sta. Boston) — COURT HOUSE—City of Boston, Dpt. P. Buildings, 2 story, basement, granite addition, to Suffolk Constr. Co., 70 Norwell St., Dorchester. Est. $160,000. Noted July 17.

N. J., Bloomfield—FIREHOUSE—Bd. Boro Council, Town Hall, general contract 2 story, basement, brick, steel, fire house, to R. M. McLeod Inc., South Oraton Parkway, East Orange, $91,909—heating, to F. P. Farrell, 269 Camden St., Newark, $8,456—plumbing, to W. Baxter, 15 Grace St., $8,883—and electrical work, to E. D. Wilson, 54 Elizabeth Ave., Newark, $2,442. Grand total $111,690. Noted June 27.

BUILDINGS—UNCLASSIFIED

BIDS ASKED

Ill., Chicago—RAILROAD STATION—Illinois Central R.R. Co., A. F. Blaess, ch. engr., 135 East 11th Pl., taking bids railroad station and 400 ft. viaduct, Randolph St. $1,300,000. Graham, Anderson, Probst & White, 80 East Jackson Blvd., archts. Noted Nov. 21, 1929.

Ia., Cedar Rapids—EXCHANGE—Northwestern Bell Telephone Co., M. H. Morris, 318 South 2nd St., bids about Aug. 15, superstructure 3 story, basement, 97 x 103 ft., concrete, brick, stone, 623-31 3rd Ave. E. $250,000. J. Normile, Hubbell Bldg., Des Moines, archt., W. B. Brown, Bever Bldg., associate archt. Noted July 24.

N. J., Gladstone—ORPHANAGE—De Pace & Juster, archts., 151 West 46th St., New York, bids about Oct. 1, general contract 2 story, basement, brick, steel, plain found., for Villa O'Connor Orphanage, $150,000. Noted Aug. 7.

R. I., Providence—HOME—Jewish Home for Aged, J. Hahn, c/o Krokyn, Browne & Rosenstein, archts., 120 Milk St., Boston, Mass., taking bids 2 story, basement, brick, stone home, plain found., Morris Ave. $150,000. Noted July 10.

CONTRACTS AWARDED

Ind., Lafayette — COMMUNITY HALL — Community House Assn., Ferry St. near 6th St., general contract brick, steel, to A. E. Kennmer, 3rd and Brown Sts. Est. $150,000. Noted June 12.

Mo., St. Louis—MERCHANDISING MART—Terminal Railroad Assoc., 1800 Market St., and St. Louis Mart, Inc., 903 Wainwright St., 6,000 rein.-con. piles 25 and 30 ft., for foundation footings for merchandising mart building, 12th, 13th, Spruce and Popular Sts. to Smith & Brennan Concrete Pile Co., 4000 North 1st St. $225,000. Noted Aug. 7.

O., Cleveland — HOME for AGED — R. W. Wright, archt., 4614 Prospect Ave., 3 story, basement, 35 x 230 ft. and 40 x 70 ft., brick, steel, concrete, to Crowell & Little Constr. Co., Hanna Bldg., for Home for Aged Women, H. MacKenzie, supt., 2206 East 46th St. Est. $250,000. Noted July 26, 1928.

Va., Richmond — ORPHANAGE — St. Joseph Orphanage brick, terra cotta, stone, tile buildings on 250 acre tract at Hollybrook, near here, to John T. Wilson Constr. Co., Mutual Bldg., $648,000. Noted July 3 under "Schools."

FACTORIES AND MILLS

PROPOSED WORK

Wash., Tacoma—PAPER MILL—St. Regis Paper Co., R. B. Maltby, vice pres., 60 East 42nd St., New York, plans mill to double plant capacity. $2,000,000.

BIDS ASKED

Calif., Oakland—CANDY FACTORY—G. E. Koster, archt., 2355 Leavenworth St., San Francisco, taking bids 2 story, rein.-con., 46th St., for Burnham Candy Co., 3800 Piedmont Ave. $45,000.

Idaho, Wallace—FLOTATION PLANT—See "Contracts Awarded."

Ia., Sioux City—BAKERY—See "Contracts Awarded."

Mass., Billerica — EQUIPMENT — Boston & Maine R.R., W. J. Backes, ch. engr., Boston, taking bids 1 story, brick, steel sand blast equipment building, $40,000. Private plans.

N. J., Harrison — FACTORY — Driver-Harris Co., Middlesex St., bids about Oct. 1, general contract 1 and 2 story, basement, addition, Middlesex St. $250,000. J. A. Finegan, 776 Broad St., Newark, archt. Noted July 31.

N. J., Linden—FACTORY—Warren & Wetmore, archts., 16 East 44th St., New York, taking bids general contract 1 story, basement, 142 x 225 ft., brick, steel, factory, for J. T. Norman, Inc., 400 Madison Ave., New York, est. $100,000.

N. J., Newark—LAUNDRY—H. D. Scudder, archt., 9 Clinton St., taking bids general contract 2 story, basement, brick, steel, addition, 89-103 Park Ave., for Crippled Childrens Home, Park Ave., $40,000.

N. J., Union City — DAIRY — G. Willaredt, archt., 411 23rd St., West New York, bids about Sept. 15, general contract 2 story, basement 28 x 155 ft., brick, steel, dairy plant addition, 45th St. and New York Ave., for Consumers Dairy Co., 400 45th St., $450,000. Noted Aug. 1.

Pa., Pittsburgh — DAIRY — McCormick Co., Inc., archts., 121 South Negley Ave., soon lets contract 3 story, 120 x 120 ft., rein.-con., Blvd. of Allies, for Islay Dairy Co., C. Islay, pres., 1033 Mahoning Ave., Youngstown, O. $200,000.

CONTRACTS AWARDED

Calif., Long Beach—STEEL PLANT—Ford Motor Car Co., 3674 Schaefer Rd., Dearborn, Mich., 1 story, 86 x 480 ft., rein.-con., brick pressed steel unit, to Clinton Constr. Co., Spring-Arcade Bldg., Los Angeles, $350,000.

Calif., Oakland—CREAMERY—Willow Brook Dairy, 1 and 2 story, brick, tile, San Pablo Ave., to E. Campomenosi, 6401 Broadway Terrace, $65,000.

Conn., Seymour—MILL—Ponds Extract Co., A. T. Tong, supt., 1 story basement, brick, steel addition, plain found., Beach St., to Aberthaw Co., 80 Federal St., Boston, Mass. Est. $45,000.

Idaho, Wallace — FLOTATION PLANT — Mutual Mines Devil Co., c/o Russell F. Collins, dir., Coeur d'Alene, 100 ton flotation mill, 300 ton crusher, by day labor.

Ill., Chicago—PRINTING PLANT—Chicago Daily News, 400 West Madison St., general contract 3 story, 80 x 196 ft., concrete printing plant West 56th St., near Oakley Blvd., to R. C. Wieblodt Co., 1412 West Washington Blvd.

Ill., Chicago—FACTORY—Vortex Cup Co., P. T. Potts, 421 North Western Ave., masonry, concrete and carpentry 4 story, brick, factory, 400 North Western Ave. to J. W. Snyder, 307 North Michigan Ave., est. $100,000.

Ia., Sioux City—BAKERY—M & L Baking Co., 502 West 3rd St., 2 story, basement, brick, day labor. $100,000. Noted Aug. 7.

Mo., St. Louis—CEMENT PACKING PLANT—Marquette Cement Mfg. Co., R. W. Meyers, mgr., 1632 Arcade Bldg., altering and cement packing plant addition, incl. 5 rein.-con. silos, for storing cement, 126 Malt St., to A. D. Gates Constr. Co., 1611 Chemical Bldg., est. $50,000.

Mo., St. Louis—BAKERY—Papendick Bakery Co., 3500 North Florissant St., 1 story, basement, 150 x 156 ft., rein.-con., brick, steel, addition, 3500 North Florissant Ave., to Acme Constr. Co., Railway Exchange Bldg.

Neb., Lincoln—FEED MILL—Gooch Milling & Elevator Co., brick, rein.-con. feed mill to Olson Constr. Co., 704 Stuart Bldg., $60,800.

N. J., Newark—LAUNDRY—Royal Laundry Service Co., 771 South 16th St., general contract 1 story, basement, brick, steel, addition, to L. Severini, South 16th St., est. $40,000. Noted May 15.

Pa., Pittsburgh — PLANT — Beckwith Machinery Co., Arch St. and Park Way, 110 x 204 ft., brick, steel plant, incl. showroom, warehouse, service shop, 6600 Hamilton Ave., to Austin Co., Union Trust Bldg.

POWER PLANTS

BIDS ASKED

Mich., Detroit—Aug. 18, by J. S. Foley, secy. Public Lighting Comn., 2 story, brick, steel, concrete substation, Building 7, plain found., for Dpt. Street Railways. $150,000. Smith, Hinchman & Grylls, 800 Marquette Bldg., engrs.

Mo., St. Louis—Sept. 3, by Bd. Educ., 911 Locust St., smoke stack, boiler and stoker, 1 uniflow engine. G. W. Sanger, acting building comrs.

N. J., Skillman—Aug. 22, by Dpt. Institutions & Agencies, State Office Bldg., Trenton, 2 and 3 story, basement, 70 x 90 ft., brick, steel, rein.-con., State Village of Epileptics, $100,000. Division Architecture and Constr. Trenton, archt.

CONTRACTS AWARDED

Mass., Taunton — City, Municipal Light Comn., 1 story station, to W. H. Barker, 4 Cohannet St., est. $50,000.

WAREHOUSES

CONTRACTS AWARDED

Ill., Galesburg—Chicago, Burlington & Quincy R.R., A. W. Newton, ch. engr., 547 Jackson Blvd., Chicago, 2 story, 60 x 220 ft., brick, steel, rein.-con., plain found., to J. E. Nelson & Sons, 3240 South Michigan Blvd., Chicago, est. $75,000.

O., Cleveland—Dpt. Welfare, A. T. Connar, dir. P. Wks., Columbus, brick, concrete, cold storage, kitchen and bakery building at Cleveland State Hospital, to G. H. Moehlman, Norwalk, $70,400.

Pa., Pittsburgh—Jewel Tea Co., 907 Sterrett Ave., 2 story, 70 x 100 ft., brick, steel warehouse, Forbes St. and McDevitt Pl., to Cuthbert Bros. Co., Bessemer Bldg.

Ont., Port Stanley—Dpt. P. Wks., Ottawa, for wharf warehouse, super-structure, to J. A. Vance, 15 Market Sq., Woodstock piling, to R. B. Herron, 2432 Bloor St. W., Toronto. Est. $75,000.

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